U.S. Fish & Wildlife Service

Columbia Headwaters Recovery Unit Implementation Plan for Bull Trout

(Salvelinus confluentus)

Migratory bull trout, originating from Lake Koocanusa in the Kootenai River drainage, Montana. Photograph by Joel Sartore for National Geographic; photographed with Wade Fredenberg, USFWS, on Ram Creek, British Columbia, September 2011.

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Columbia Headwaters Recovery Unit

Implementation Plan

Introduction

This recovery unit implementation plan (RUIP) describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the Columbia Headwaters Recovery Unit, including estimates of time required and cost. This document supports and complements the Recovery Plan for the Coterminous United States Population of Bull Trout (USFWS 2015a), which describes recovery criteria and a general range-wide recovery strategy for the species. Detailed discussion of species status and recovery actions within each of the six recovery units are provided in six RUIPs that have been developed in coordination with State, Federal, Tribal, and other conservation partners. This document incorporates our responses to public comment on the Draft Columbia Headwaters RUIP (USFWS 2015b) received during the comment period from June 4 to July 20, 2015 (Appendix III).

The Columbia Headwaters Recovery Unit (CHRU) includes western Montana, northern Idaho, and the northeastern corner of Washington. Major drainages include the Clark Fork River basin and its Flathead River contribution, the Kootenai River basin, and the Coeur d'Alene Lake basin. In this implementation plan for the CHRU we have slightly reorganized the structure from the 2002 Draft Recovery Plan, based on latest available science and fish passage improvements that have rejoined previously fragmented habitats. We now identify 35 bull trout core areas (compared to 47 in 2002) for this recovery unit. Fifteen of the 35 are referred to as "complex" core areas as they represent large interconnected habitats, each containing multiple spawning streams considered to host separate and largely genetically identifiable local populations. The 15 complex core areas contain the majority of individual bull trout and the bulk of the designated critical habitat (USFWS 2010a, 2010b).

However, somewhat unique to this recovery unit is the additional presence of 20 smaller core areas, each represented by a single local population. These "simple" core areas are found in remote glaciated headwater basins, often in Glacier National Park or federally-designated wilderness areas, but occasionally also in headwater valley bottoms. Many simple core areas are upstream of waterfalls or other natural barriers to fish migration. In these simple core areas bull trout have apparently persisted for thousands of years despite small populations and isolated existence. As such, simple core areas meet the criteria for core area designation and continue to be valued for their uniqueness, despite limitations of size and scope. Collectively, the 20 simple core areas contain less than 3 percent of the total bull trout core area habitat in the CHRU, but represent significant genetic and life history diversity (Meeuwig *et al*. 2010). Throughout this recovery unit implementation plan, we often separate our analyses to distinguish between complex and simple core areas, both in respect to threats as well as recovery actions.

In order to effectively manage the RUIP structure in this large and diverse landscape, we have separated the core areas into the following five natural geographic assemblages (see Figure D-1), largely reminiscent of the 2002 recovery planning structure (USFWS 2002).

Upper Clark Fork Geographic Region

Starting at the Clark Fork River headwaters, the *Upper Clark Fork Geographic Region* comprises seven complex core areas, each of which occupies one or more major watersheds contributing to the Clark Fork basin (*i.e.*, Upper Clark Fork River, Rock Creek, Blackfoot River, Clearwater River and Lakes, Bitterroot River, West Fork Bitterroot River, and Middle Clark Fork River core areas).

Lower Clark Fork Geographic Region

The seven headwater core areas flow into the *Lower Clark Fork Geographic Region*, which comprises two complex core areas, Lake Pend Oreille and Priest Lake. Because of the systematic and jurisdictional complexity (three States and a Tribal entity) and the current degree of migratory fragmentation caused by five mainstem dams, the threats and recovery actions in the Lake Pend Oreille (LPO) core area are very complex and are described in three parts. LPO-A is upstream of Cabinet Gorge Dam, almost entirely in Montana, and includes the mainstem Clark Fork River upstream to the confluence of the Flathead River as well as the portions of the lower Flathead River (*e.g.*, Jocko River) on the Flathead Indian Reservation. LPO-B is the Pend Oreille lake basin proper and its tributaries, extending between Albeni Falls Dam downstream from the outlet of Lake Pend Oreille and Cabinet Gorge Dam just upstream of the lake; almost entirely in Idaho. LPO-C is the lower basin (*i.e.*, lower Pend Oreille River), downstream of Albeni Falls Dam to Boundary Dam (1 mile upstream from the Canadian border) and bisected by Box Canyon Dam; including portions of Idaho, eastern Washington, and the Kalispel Reservation. Historically, and for current purposes of bull trout recovery, migratory connectivity among these separate fragments into a single entity remains a primary objective.

Flathead Geographic Region

The *Flathead Geographic Region* includes a major portion of northwestern Montana upstream of Kerr Dam on the outlet of Flathead Lake. The complex core area of Flathead Lake is the hub of this area, but other complex core areas isolated by dams are Hungry Horse Reservoir (formerly South Fork Flathead River) and Swan Lake. Within the glaciated basins of the Flathead River headwaters are 19 simple core areas, many of which lie in Glacier National Park or the Bob Marshall and Great Bear Wilderness areas and some of which are isolated by natural barriers or other features.

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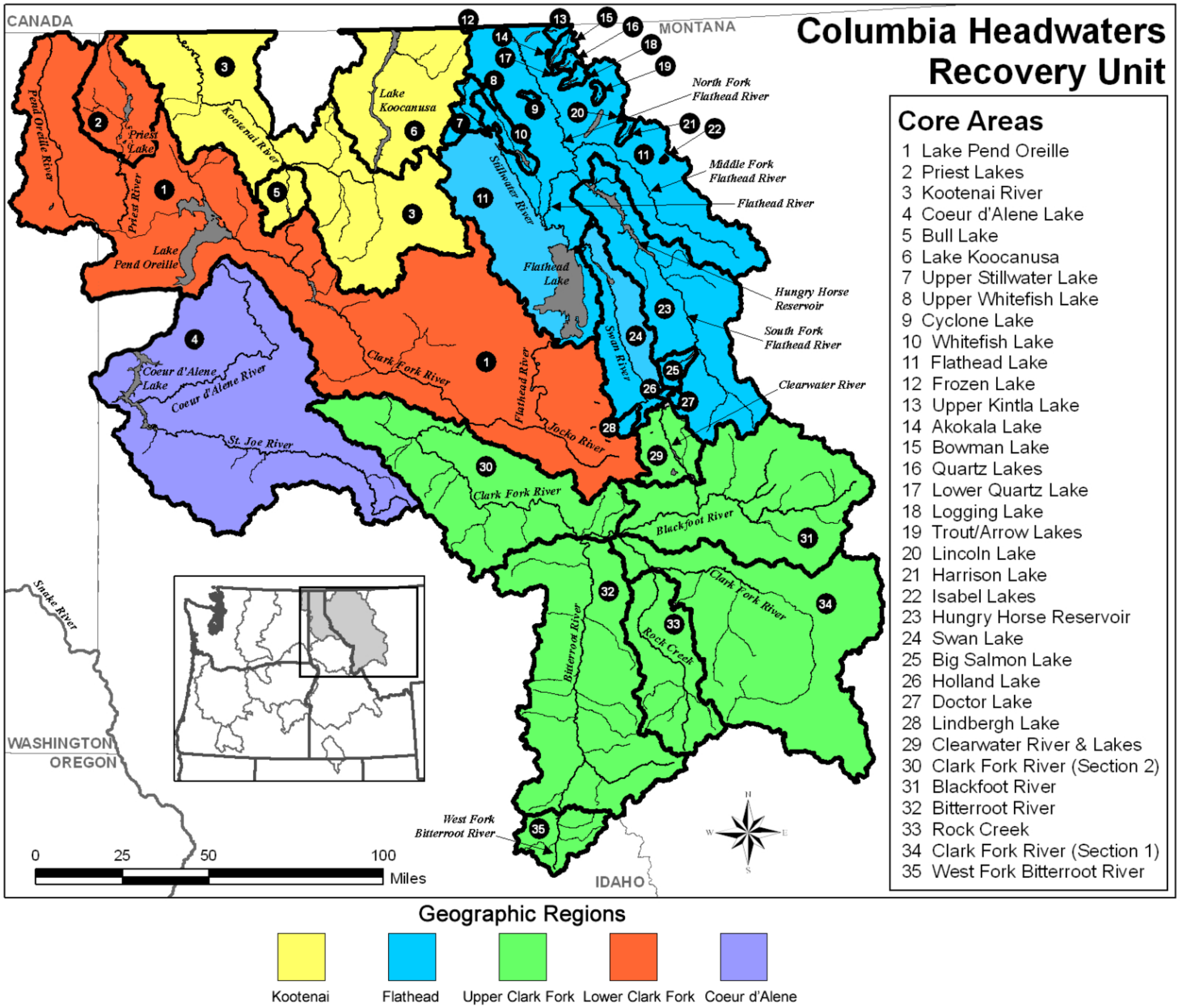

Figure D-1. Map of the Columbia Headwaters Recovery Unit for Bull Trout.

Kootenai Geographic Region

To the northwest of the Flathead, in an entirely separate watershed, lies the *Kootenai Geographic Region*. The Kootenai is a uniquely patterned river system that originates in southeastern British Columbia, Canada. It dips, in a horseshoe configuration, into northwest Montana and north Idaho before turning north again to re-enter British Columbia and eventually join the Columbia River headwaters in British Columbia. The *Kootenai Geographic Region* contains two complex core areas (Lake Koocanusa and the Kootenai River) bisected since the 1970's by Libby Dam, and also a single naturally isolated simple core area (Bull Lake). Bull trout in both of the complex core areas retain strong migratory connections to populations in British Columbia.

Coeur d'Alene Geographic Region

Finally, the *Coeur d'Alene Geographic Region* consists of a single, large complex core area centered on Coeur d'Alene Lake. It is grouped into the CHRU for purposes of physical and ecological similarity (adfluvial[1] bull trout life history and nonanadromous linkage) rather than due to watershed connectivity with the rest of the CHRU, as it flows into the mid-Columbia River far downstream of the Clark Fork and Kootenai systems.

Life History Characteristics

It is within the broad array of local populations that the full diversity of bull trout within the CHRU is exemplified (USFWS 2002, 2008a). Because the stepdown organizational hierarchy of bull trout in the CHRU remains important for purposes of implementing recovery, tracking consultation under section 7 of the Endangered Species Act, identifying and protecting critical habitat, and other aspects of planning and coordination, we present a current list of the local populations, by core area (Appendix I). This list has been modified over time and will likely continue to be modified as new information on bull trout movement and distribution is developed in the future. At present, there are 143 recognized local populations of bull trout in the 15 complex core areas (range 2 to 35) and 20 more (1 each) in the simple core areas for a total of 163 local populations in the CHRU.

Unique to the CHRU is that the bull trout life history in most of the core areas (29 of 35) is considered predominantly adfluvial, with adult and subadult fish largely residing in lake or reservoir habitats during much of their life. Some spawning and rearing (SR) streams are 100 miles (161 kilometers [km]) or more upstream from the lake of adult origin, so extensive migrations both upstream (by adults) and downstream (by juveniles and post-spawn adults) are required and were part of the evolutionary history of most of these populations. In other cases, the lake habitat is closely attached to the SR streams, so migration as short as a few hundred yards allows those fish to reach the SR habitat. A systematic assessment of the linear extent of

[1] Adfluvial: Life history pattern of spawning and rearing in tributary streams and migrating to lakes or reservoirs to mature.

occupied habitat, by watershed, performed by the State fishery managers in 2005 and submitted to the U.S. Fish and Wildlife Service (Service) as part of the initial 5-year review (IDFG and MFWP 2005) found that bull trout populations were predominantly adfluvial in the simple core areas. Of the complex core areas, the adfluvial life history form also dominates in Lake Pend Oreille, Priest Lakes, Coeur d'Alene Lake, Lake Koocanusa, Clearwater River and Lakes, Flathead Lake, Swan Lake, Hungry Horse Reservoir, and the West Fork Bitterroot River (Painted Rocks).

In six complex core areas, those populations occupying mainstem riverine habitat, the populations are also migratory, but primarily fluvial[2] (USFWS 2008a). The fluvial life history form is considered dominant in the Blackfoot River and Rock Creek, though with a nearly equal share of habitat occupied by resident[3] bull trout in the latter case. Across the CHRU, where migratory opportunities have been truncated (either due to natural conditions or, in most cases, due to human impacts) some local populations have assumed a largely resident life history (Nelson *et al*. 2002, Rich *et al*. 2003). In the Bitterroot River, Upper Clark Fork River, and Middle Clark Fork River core areas the resident life history form (typically in combination with substantive reaches where life history status was considered "unknown") tends to dominate (IDFG and MFWP 2005). It is likely not a coincidence that these complex core areas are also the three where formerly fluvial and adfluvial populations have been subjected to the longest and most intense fragmentation history. Prior to human impacts, these systems were likely also dominated by bull trout populations exhibiting the migratory life history form.

Where given the opportunity, resident populations seem to be capable of re-establishing their natural migratory pattern (Al-Chokhachy *et al*. 2015). Bull trout recovery objectives throughout the CHRU continue to emphasize the protection and/or restoration of the migratory form as the strategy most likely to conserve bull trout across the CHRU landscape.

Current Status of Bull Trout in the Columbia Headwaters Recovery Unit

Status Overview

With the exception of much of the headwaters of the Clark Fork River drainage (upstream of Rock Creek) and portions of the Coeur d'Alene River system, both of which were severely degraded by contamination by heavy metals, bull trout continue to be present (albeit sometimes in low numbers) in most major watersheds where they likely occurred historically in the CHRU (USFWS 2002). Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993), the fish are not expected to simultaneously occupy all available habitats (Rieman *et al*. 1997). This patchiness is evident throughout the CHRU and, as will be discussed, is largely tied to the presence of cold water SR habitat.

[2] Fluvial: Life history pattern of spawning and rearing in tributary streams and migrating to larger rivers to mature.
[3] Resident: Life history pattern of residing in tributary streams for the fish's entire life without migrating.

In some watersheds within the CHRU, or portions of them, bull trout were probably never numerous because of natural habitat limitations (USFWS 2002, 2008a). Despite the intact broad distribution of bull trout core areas, a number of local populations of bull trout have been extirpated in recent times. Examples include portions of the upper Clark Fork and lower Pend Oreille drainages. Bull trout numbers have also been reduced to remnant status in several simple core areas where lakes have been stocked with or invaded by nonnative lake trout (*e.g.*, Whitefish Lake, Upper and Lower Stillwater Lakes, and Logging Lake) (USFWS 2008a).

Population trend data is largely unavailable for bull trout in the CHRU prior to monitoring that began in some complex core areas as early as the 1960's, but mostly in the 1980's or later. Trend data remains unavailable for many simple core areas. Because of the generally large size of the migratory fish in this RU and the ease with which surveyors are able to recognize spawning redds, the use of redd counts (Spalding 1997) has been shown to provide a repeatable method of indexing spawner escapement in many local populations (Al-Chokhahy and Budy 2005) (Muhlfeld *et al*. 2005). The most complete database has been accumulated for the Flathead Lake, Swan Lake, and Lake Pend Oreille core areas (IDFG 2014, MFWP 2014). Similar trend data has been accumulated for Rock Creek, the Blackfoot River, the St. Joe River, Upper Priest River, and several of the Flathead basin lakes, but the period of record is generally shorter and frequency of counting is more sporadic. In some cases, the numbers of spawning bull trout in core areas of the CHRU are too low to accurately identify primary spawning reaches of tributary streams. In other core areas, confusion with other fall spawning species (*e.g.*, kokanee, brown trout) and/or resident bull trout and brook trout makes redd counts less dependable as an indexing method.

Additional effort has been focused in some basins on monitoring juvenile abundance in primary SR habitat. The basins where juvenile abundance monitoring data exists tend to be the same as those with extensive redd count information (above). Assessing trends in bull trout abundance from a single parameter is difficult, given the relatively complex life cycle of the migratory fish. The interrelationships between juvenile abundance and adult return as well as between redd counts and juvenile abundance remains complex and can be difficult to interpret (Whitesel *et al*. 2004, Al-Chokhachy *et al*. 2015).

For the most recent bull trout 5-year status review, the Service concluded that bull trout core areas in the CHRU were at overall risk levels similar to those rangewide (USFWS 2008a). This conclusion was based on a systematic core area status assessment using a modification of the Natural Heritage Program's ranking model (Master *et al*. 2003). This analysis ranked the extirpation risk of bull trout by individual core area. Data used to rank the core areas consisted of information on population abundance, distribution, population trend, and threats to bull trout which were summarized by core area in the Core Area Templates document (USFWS 2008a). Complete details of the assessment are described in the Bull Trout Core Area Assessment (USFWS 2008b). Categories of risk were described as follows: *High Risk* – Core area at high risk because of extremely limited and/or rapidly declining numbers, range, and/or habitat, making the bull trout in this core area highly vulnerable to extirpation. *At Risk* – Core area at risk because of very limited and/or declining numbers, range, and/or habitat, making the bull trout in this core area vulnerable to extirpation. *Potential Risk* – Core area potentially at risk because of limited and/or declining numbers, range, and/or habitat even though bull trout may be locally abundant in some portions of the core area. *Low Risk* – Bull trout common or uncommon, but not rare, and usually widespread through the core area. Apparently not vulnerable at this time, but may be cause for long-term concern.

Conclusions from the 5-year review (USFWS 2008a, 2008b) were that 13 of the CHRU core areas were at High Risk (37.1 percent), 12 were considered At Risk (34.3 percent), 9 were considered at Potential Risk (25.7 percent), and only 1 core area (Lake Koocanusa; 2.9 percent) was considered at Low Risk. Simple core areas, due to limited demographic capacity and single local populations were generally more inherently at risk than complex core areas under the model. While this assessment was conducted nearly a decade ago, little has changed in regard to individual core area status in the interim.

Implementation Planning Process

In December 2014, interagency meetings were held in each of the five major geographical areas; the upper Clark Fork, lower Clark Fork/Lake Pend Oreille, Flathead, Kootenai, and Coeur d'Alene. The purposes of these meetings were: 1) to review and discuss primary threats to bull trout in core areas where attendees maintain expertise; 2) to help in identify existing plans and recovery tasks; and 3) to develop new recovery actions for inclusion in this plan. Representatives of State, Tribal, Federal, and non-governmental watershed groups were invited to participate. Each meeting focused on core areas in and around the meeting site (Table D-1). Approximately 120 people attended the 5 meetings. Meeting minutes were kept at each meeting and transcribed as part of the administrative record for the RUIP.

Meeting attendees were asked to provide existing plans, conservation projects, and reports related to bull trout conservation within their areas. Documents provided ranged from individual project reports to State and forest-wide conservation plans. Over 60 documents were reviewed to determine what recovery actions were underway, had been completed, or were identified as priorities within the respective core areas. Individual tasks from existing plans were classified by primary threat focus and compiled into a threats matrix in this RUIP. The intent was to identify those actions already being pursued and to highlight primary threats that may require additional planning and attention to address. Discussions at the meetings also highlighted actions identified in previous bull trout recovery plans and reviews that had been completed or that were no longer considered conservation priorities because of changes in core area management, new information from field surveys, or research results.

Table D-1. Core Areas reviewed in Columbia Headwaters Recovery Unit implementation planning meetings.

Missoula	Kalispell (3 groups)		Libby	Sandpoint	Coeur d'Alene
Bitterroot River	Akokala Lake	Harrison Lake	Bull Lake	Lake Pend Oreille	Coeur d'Alene Lake
Blackfoot River	Big Salmon Lake	Lincoln Lake	Kootenai River	Priest Lakes	
Clearwater River & Lakes	Doctor Lake	Logging Lake	Lake Koocanusa		
Middle Clark Fork	Frozen Lake	Lower Quartz Lake			
Rock Creek	Trout/Arrow Lakes	Quartz Lakes			
Upper Clark Fork	Upper Kintla Lake	Holland Lake			
West Fork Bitterroot River	Hungry Horse Reservoir	Flathead Lake			
	Isabel Lakes	Lindbergh Lake			
	Bowman Lake	Swan Lake			
	Cyclone Lake	Upper Stillwater Lake			
	Upper Whitefish Lake	Whitefish Lake			

Factors Affecting Bull Trout in the Columbia Headwaters Recovery Unit

In this section we summarize significant threats that were determined to affect bull trout in the 35 core areas of the CHRU. Threats are described in detail and at the individual core area level in Table D-2. Primary threats are those factors known or likely (i.e., non-speculative) to negatively impact bull trout populations at the core area level, and accordingly require management actions to assure bull trout persistence to a degree necessary that bull trout will not be at risk of extirpation within that core area in the foreseeable future.

As previously noted, the largely adfluvial nature of the core areas in the CHRU (29 of 35, or 83 percent are adfluvial) makes them susceptible to certain threats (*e.g.*, nonnative fish invasion and mainstem migratory barriers), but at the same time may allow for greater resiliency due to the highly suitable cold water habitat that the lakes provide and the general robust size, condition, and fecundity of adfluvial fish, able to capitalize on high quality forage bases that lakes may also contain (Beauchamp and VanTassell 2001, Downs *et al*. 2006, Johnston and Post 2009, Meeuwig *et al*. 2011). We separate threats by three broad categories within the Primary Threat Analysis (Table D-2): Habitat Threats, Demographic Threats, and Nonnative Species Threats.

Generally speaking, the smaller bull trout core areas sit higher in the watersheds, and a greater proportion of the total stream length in them is occupied by bull trout, due largely to colder stream temperatures. Exceptions are noted in the Upper Clark Fork core area, where most migratory fish were largely extirpated by poor water quality from historic mining effluents. The extreme fragmentation in the Upper Clark Fork reduced bull trout occupancy to a few, relatively discrete, largely disconnected tributary patches occupied by resident fish. As a result, recovery of the migratory form is likely to be a long-term process, if indeed it’s even attainable. Similar impacts occurred in headwater areas within the Coeur d’Alene Lake basin (North Fork and South Fork Coeur d’Alene Rivers) where mining effluents contributed to the extirpation of migratory local populations. The Bitterroot River core area also stands out as having a relatively large amount of occupied SR habitat (2010 known occupancy database) despite retaining a very weak migratory bull trout component. This broad resident distribution in the Bitterroot River core area, somewhat anomalous in the CHRU, is largely attributed to the persistence of resident populations despite a lack of migratory connectivity. Lake Koocanusa is also a somewhat anomalous core area. Because this RUIP analysis (and the listed entity) does not account for extensive portions of the Kootenai River watershed upstream in British Columbia, where most bull trout spawning and rearing takes place, a direct comparison of the Koocanusa metrics to the other core areas is not very meaningful. To a lesser extent, portions of SR habitat for Flathead Lake and Kootenai River core areas are also in British Columbia, Canada and are not adequately accounted for.

Table D-2. Primary Threats by Core Area in the Columbia Headwaters Recovery Unit, listed in hydrological downstream order by major category (Habitat-Based, Demographic, and Nonnative Species) with subheadings. All threats listed are considered "primary", without rank. LWD = large woody debris; FMO = foraging, migrating, and overwintering habitat, SR = spawning and rearing habitat.

Geographic Region **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS** ***HABITAT***	**PRIMARY THREATS** ***DEMOGRAPHIC***	**PRIMARY THREATS** ***NONNATIVES***
Upper Clark Fork Geographic Region				
Upper Clark Fork River	**3**	**Upland/Riparian Land Management** (1.1) Forest practices (roads, sediment) and livestock grazing are causing riparian and instream degradation, loss of LWD, and pool reduction in FMO habitat and some SR habitat in tributaries. **Water Quality** (1.3) Agricultural practices (including irrigation) and residential developments reduce and fragment suitable habitat and migration corridors. Irrigation, industrial, and municipal uses result in further dewatering of some habitat. Runoff from mining in the early 20th century resulted in toxic conditions for aquatic species in large portions of the mainstem FMO habitat and some headwater tributaries due to concentrations of heavy metals and other contaminants. Low water quality is still affecting bull trout in some areas, though it is slowly improving.	**Connectivity Impairment** (2.1) Fragmentation of tributary SR habitat, as well as mainstem Clark Fork River FMO habitat by dams and diversions combined with major loss of bull trout distribution in occupied tributaries, is limiting recovery potential, even if other threats are resolved. This threat is aggravated by dewatering and entrainment in irrigation systems, especially in lower reaches of tributaries.	**Nonnative fishes** (3.1) Brook trout are abundant and high rates of hybridization with bull trout have been documented in some SR tributaries (*e.g.*, Warm Springs Creek).

<u>**Geographic Region**</u> **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS** ***HABITAT***	**PRIMARY THREATS** ***DEMOGRAPHIC***	**PRIMARY THREATS** ***NONNATIVES***
		Water temperature in the mainstem FMO habitat and lower reaches of most tributaries is marginally high for bull trout survival in the summer. The elevated water temperatures are often exacerbated by instream flow depletion for human uses.		
Rock Creek	**9**	**Water Quality** (1.3) Water temperature in mainstem FMO habitat and lower reaches of tributaries in the downstream portions of the core area are marginally high for bull trout survival in the summer. The elevated water temperatures are often exacerbated by instream flow depletion for human uses.	None	**Nonnative fishes** (3.1) Brook trout occur in some tributaries with SR habitat and hybridization has been documented.

<u>Geographic Region</u> **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS** ***HABITAT***	**PRIMARY THREATS** ***DEMOGRAPHIC***	**PRIMARY THREATS** ***NONNATIVES***
Blackfoot River	**6**	**Upland/Riparian Land Management** (1.1) Active livestock grazing combined with forest practices and the ongoing use and management of roads and transportation corridors threatens bull trout in the lower Blackfoot River mainstem FMO habitat and downstream reaches of some SR tributaries by causing riparian and instream degradation, loss of LWD, and pool reduction. **Water Quality** (1.3) Dewatering in the upper Blackfoot River mainstem FMO habitat and some tributaries contributes to seasonally high summer water temperatures, often aggravated by instream flow depletion. Dewatering of numerous reaches, collectively extending over 100 miles of waterway, has been documented. This reaches critical levels in the lower mainstem. Bull trout become isolated in pockets of thermal refugia at the confluence of a few cold water tributaries, where they are very vulnerable to anglers and predators. Contamination from mine runoff, mostly from historical sources (*e.g.*, Mike Horse Mine), is an ongoing threat to water quality, though water quality is slowly improving.	**Small Population Size** (2.3) Small Population Size and fragmentation may be limiting in key SR tributaries in the lower drainage (*e.g.*, Gold and Belmont Creeks, where redd counts were routinely double digits prior to 2000, but now seldom exceed 1 or 2),	**Nonnative fishes** (3.1) Brook trout occurrence and hybridization is high in some SR tributaries, especially in the lower watershed.

<u>**Geographic Region**</u> **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS** ***HABITAT***	**PRIMARY THREATS** ***DEMOGRAPHIC***	**PRIMARY THREATS** ***NONNATIVES***
Clearwater River & Lakes	**4**	**Upland/Riparian Land Management** (1.1) Industrial forestry impacts and extensive road networks on formerly private timber lands, cause riparian and instream degradation, loss of LWD, and pool reduction in FMO habitat and some SR tributaries. These lands have recently passed into the public ownership.	None	**Nonnative fishes** (3.1) Brook trout are ubiquitous in all but the coldest SR tributaries. Hybridization is a significant threat.
West Fork Bitterroot River	**6**	None	None	**Nonnative fishes** (3.1) Brook trout occur in high numbers in some SR habitat. The extent of hybridization or other impacts are not well documented.
Bitterroot River	**14**	**Upland/Riparian Land Management** (1.1) Sediment from forest roads, logging practices, livestock grazing, and agricultural practices (irrigation impacts and dewatering) are causing riparian and instream degradation, loss of LWD, and pool reduction in FMO habitat and some SR tributaries. This is especially acute on private lands mostly downstream of National Forest SR habitat. Extensive residential development of riparian and uplands, especially in the lower (valley) reaches of many tributaries is exacerbating the effects of dewatering, entrainment, and blockage of upstream fish passage due to	**Connectivity Impairment** (2.1) Fragmentation of SR habitat is extreme and connectivity with FMO habitat is poor. Migratory life forms are being lost due primarily to irrigation diversions. Further range reduction of bull trout in remaining patches of occupied SR habitat may limit recovery potential, even if other threats are resolved. Resident bull trout populations are doing relatively well on the east side of the Bitterroot, but most are isolated and are not contributing migratory individuals to the core area.	**Nonnative fishes** (3.1) Brook trout are common on the west side of the drainage and hybridization is well-documented in some SR tributaries.

<u>**Geographic Region**</u> **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS** ***HABITAT***	**PRIMARY THREATS** ***DEMOGRAPHIC***	**PRIMARY THREATS** ***NONNATIVES***
		irrigation, roads, overgrazing and a myriad of other human activities. **Instream Impacts** (1.2) Transportation corridors along riparian areas contribute to instream habitat degradation through the loss of LWD, pool reduction, increased sedimentation, and loss of structure due to streambank stabilization in some SR tributaries (*e.g.*, Lolo Creek). **Water Quality** (1.3) Dewatering of the Bitterroot River mainstem FMO habitat and lower portions of most SR tributaries contributes to seasonally critical high temperatures in the mainstem downstream of Hamilton. There are few remaining bull trout in the mainstem and those that are become isolated in pockets of thermal refugia where they are very vulnerable to anglers and predators.		
Middle Clark Fork River	**10**	**Upland/Riparian Land Management** (1.1) Sediment from forest roads, logging, and livestock grazing cause riparian and instream degradation, loss of LWD, and pool reduction in FMO habitat and some SR tributaries. Legacy impacts of industrial forestry and extensive road networks on formerly private timber lands continue to affect bull trout.	None	**Nonnative fishes** (3.1) Brook trout are ubiquitous in some SR tributaries (*e.g.*, St. Regis River drainage, Rattlesnake Creek), and are especially problematic in those occupied by resident bull trout. Hybridization is currently not well documented.

Geographic Region **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS** ***HABITAT***	**PRIMARY THREATS** ***DEMOGRAPHIC***	**PRIMARY THREATS** ***NONNATIVES***
		Instream Impacts (1.2) Historic placer mining significantly changed stream hydrology, created sediment sources and caused passage issues in some SR tributaries (*e.g.*, Cedar Creek) and the effects are still felt today. **Water Quality** (1.3) Existing water temperatures in mainstem FMO habitat and lower reaches of most tributaries are marginally high for bull trout survival in the summer, and conditions are worsening. This concentrates bull trout in isolated pockets of cold water at the mouths of cold water tributaries where they are highly vulnerable to anglers and predators.		
Lower Clark Fork Geographic Region				
Lake Pend Oreille A **(Portions of Montana upstream of Cabinet Gorge Dam)**	**15**	**Upland/Riparian Land Management** (1.1) Sediment from forest roads, logging, and livestock grazing cause riparian and instream degradation, loss of LWD, and pool reduction in FMO habitat and most SR tributaries upstream of Cabinet Gorge Dam (*e.g.*, Thompson River). **Instream Impacts** (1.2) Transportation and utility corridors along riparian areas contribute to	**Connectivity Impairment** (2.1) The FMO habitat is fragmented by large mainstem dams leading to low population size and risk of extirpation on now isolated SR habitat. Bull trout are currently trucked and transported upstream at Cabinet Gorge and Noxon Rapids Dams on the Clark Fork River. Improved connectivity) is necessary to fully remediate the effects of this fragmentation and enhance persistence of bull trout in isolated upstream SR habitat in Montana.	**Nonnative fishes** (3.1) Nonnative lake trout, smallmouth and largemouth bass, walleye (recent), northern pike, and brown trout occupy the artificial reservoir habitat (FMO) in Cabinet Gorge, Noxon Rapids, and Thompson Falls Reservoirs. All are highly piscivorous species. They may prey on bull trout to varying degrees (especially migrating juveniles).

<u>Geographic Region</u> **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS** ***HABITAT***	**PRIMARY THREATS** ***DEMOGRAPHIC***	**PRIMARY THREATS** ***NONNATIVES***
		degradation through the loss of LWD, pool reduction, and increased sedimentation in some SR tributaries (*e.g.*, Thompson River, Prospect Creek, and Cooper Gulch). Past placer mining, as well as active and proposed mines (*e.g.*, Vermilion River, Rock Creek) affect hydrology, increase sediment, and cause passage issues for bull trout. **Water Quality** (1.3) Water temperatures in mainstem FMO habitat in Cabinet Gorge, Noxon Rapids, and Thompson Falls Reservoirs; and lower reaches of most tributaries are marginally high for bull trout survival in the summer, and conditions are worsening. This concentrates bull trout in isolated pockets of cold water at the mouths of cold water tributaries where they are highly vulnerable to anglers and predators.		
Lake Pend Oreille B **(Portions of north Idaho contiguous with the basin of Lake Pend Oreille)**	**19**	**Upland/Riparian Land Management** (1.1) Legacy impacts from forest roads, logging, and fires increase sediment and cause riparian and instream degradation, loss of LWD, and pool reduction in FMO habitat and some SR tributaries (*e.g.*, Lightning and Grouse Creeks and Pack River).	None	

<u>Geographic Region</u> **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS** ***HABITAT***	**PRIMARY THREATS** ***DEMOGRAPHIC***	**PRIMARY THREATS** ***NONNATIVES***
Lake Pend Oreille C **(Portions of Idaho and Northeast Washington Downstream of Albeni Falls Dam to Boundary Dam)**	**1**	**Upland/Riparian Land Management** (1.1) Sediment from forest roads, logging, and livestock grazing cause riparian and instream degradation, loss of LWD, and pool reduction in FMO habitat and most SR tributaries downstream of Albeni Falls Dam (*e.g.*, LeClerc Creek, Calispell Creek, and Tacoma Creek). **Instream Impacts** (1.2) Transportation, flood control, and utility corridors along riparian areas contribute to degradation through the loss of LWD, pool reduction, and increased sedimentation in some SR tributaries (*e.g.*, Sullivan Creek, Indian Creek, Calispell Creek and Tacoma Creek). Historic placer mining significantly changed the hydrology, created sediment sources and caused passage issues (*e.g.*, Sullivan Creek) and the effects are still felt today. **Water Quality** (1.3) Water temperatures in mainstem FMO habitat (lower Pend Oreille River and run-of-the river reservoirs), and lower reaches of most tributaries are marginally high for bull trout survival in the summer, and conditions are worsening. Artificial pools created by	**Connectivity Impairment** (2.1) FMO habitat is fragmented by Albeni Falls Dam and Box Canyon Dam leading to low population size and risk of extirpation on now isolated SR habitat. Bull trout are currently, though sporadically, trucked and transported over Albeni Falls Dam. Safe, timely, and effective upstream and downstream passage is necessary to fully remediate effects of fragmentation and to enhance persistence of bull trout in isolated downstream SR habitat in Idaho and Northeast Washington. Lack of upstream and downstream passage at Box Canyon Dam increases the risk to the persistence of bull trout in isolated systems downstream. **Small Population Size** (2.3) Small population size and fragmentation is severely limiting bull trout survival and recovery in key SR tributaries in the lower drainage (*e.g.*, LeClerc and Sullivan Creeks). Survival of bull trout in this portion of the lower Clark Fork is at risk.	**Nonnative fishes** (3.1) Nonnative northern pike, smallmouth bass, walleye (recent), and to a lesser extent brown trout and occasional lake trout occupy the artificially created habitat (FMO) downstream of Albeni Falls Dam. All are and highly piscivorous species. Situationally (temporally and spatially) these species may prey on bull trout to varying degrees (especially migrating juveniles). Given the low abundance in this area, any loss is significant. In SR habitat, brook trout occur in high numbers in some streams, especially in lower elevations. Hybridization is observed frequently due to low bull trout population (*e.g.*, LeClerc Creek).

Geographic Region Core Area (Complex) *Core Area (Simple)*	Number of Local Populations	PRIMARY THREATS *HABITAT*	PRIMARY THREATS *DEMOGRAPHIC*	PRIMARY THREATS *NONNATIVES*
		operation of Albeni Falls, Box Canyon, and Boundary Dams warm and perpetuate high water temperatures in summer, delaying or hindering movement of bull trout to spawning tributaries.		
Priest Lakes	**5**	**Upland/Riparian Land Management** (1.1) Legacy forest practices (roads, sediment) cause riparian and instream degradation, loss of LWD, and pool reduction in FMO habitat and some SR tributaries (*e.g.*, Gold Creek, Hughes Fork, Granite Creek).	None	**Nonnative fishes** (3.1) Lake trout in Priest Lake have severely reduced bull trout survival through predation and/or competition, and have contributed to near collapse of several local populations. Despite suppression actions for lake trout, their continual reinvasion of Upper Priest Lake through the Thorofare is difficult to manage and places at risk the relatively more secure headwaters as well. Brook trout are common in SR in Priest and Upper Priest local populations. Hybridization reduces bull trout resiliency and replication in the face of lake trout and habitat pressures as well.
Flathead Geographic Region				
Flathead Lake	**17**	None	**Fisheries Management** (2.2) Loss of bull trout from angling bycatch mortality (combined Flathead Lake and River system) and occasional poaching contributes to the low populations in this system. Low population size (single digit redd counts) are a concern in some SR tributaries, especially in	**Nonnative fishes** (3.1) In the 1980's, the nonnative lake trout expanded in the Flathead Lake and mainstem Flathead River FMO habitat, triggered by the *Mysis* introduction (now estimated 1+ million lake trout population). Concurrently, the complete collapse of

<u>Geographic Region</u> **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS** ***HABITAT***	**PRIMARY THREATS** ***DEMOGRAPHIC***	**PRIMARY THREATS** ***NONNATIVES***
			recent years in the North Fork Flathead SR streams. Sampling mortality of bull trout due to aggressive monitoring in SR habitat (*e.g.*, North Fork Flathead) and gillnetting for lake trout suppression in Flathead Lake may directly impact potential recruitment and reduce local populations.	the formerly abundant kokanee forage base for lake trout likely lead to substantial increase in predation of bull trout and competition for other foods. This combination of effects likely caused the subsequent rapid decline in bull trout, demonstrated by a 75 percent decline in redd counts from the 1980s levels. Partial recovery of bull trout occurred in the 2000's (to approx. one-half 1980's levels) but gains have stagnated and are fluctuating below conservation objectives. Nonnative lake trout predation and competition remains a substantial threat to bull trout in this system. Predation from nonnative northern pike populations in the mainstem Flathead River is a documented threat.
Frozen Lake	**1**	None	None	None
Upper Kintla Lake	**1**	None	None	None

<u>Geographic Region</u> **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS** ***HABITAT***	**PRIMARY THREATS** ***DEMOGRAPHIC***	**PRIMARY THREATS** ***NONNATIVES***
Akokala Lake	**1**	None	None	None
Bowman Lake	**1**	None	**Small Population Size** (2.3) Single local population is remnant; may be smaller than what is sustainable/ viable (*i.e.*, low single digit redd count consecutively for over a decade). Naturally unstable SR habitat partly to blame; also may be aggravated by angling loss, facilitated by road access and developed boating opportunity.	**Nonnative fishes** (3.1) Lake trout invasion, within the past ~50 years, has led to seriously reduced bull trout population through unknown mechanisms of competition and/or predation.
Quartz Lakes	**1**	None	None	**Nonnative fishes** (3.1) Lake trout invasion within the past ~20 years is being aggressively deterred by suppression actions (targeted gillnetting). Bull trout population is currently stable.
Lower Quartz Lake	**1**	None	None	**Nonnative fishes** (3.1) Lake trout invasion within the past ~20 years, bull trout population impact unknown.
Cyclone Lake	**1**	None	**Small Population Size** (2.3) Population size is naturally limited due to size of core area, relatively warm and shallow FMO habitat in the lake, and limited SR habitat, but lower than what may be sustainable or viable. May be aggravated by direct take from angling, facilitated by road accessibility.	None

<u>Geographic Region</u> **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS** ***HABITAT***	**PRIMARY THREATS** ***DEMOGRAPHIC***	**PRIMARY THREATS** ***NONNATIVES***
Logging Lake	**1**	None	**Fisheries Management** (2.2) Planned future lake trout suppression actions (gillnetting) may cause some additional bull trout bycatch loss. **Small Population Size** (2.3) Single local population size lower than what may be sustainable or viable (*i.e.*, formerly robust population is now reduced to low single digit redd count over recent decade).	**Nonnative fishes** (3.1) Lake trout invasion within the past ~30 years has seriously reduced bull trout population through unknown mechanisms of competition and/or predation.
Trout/Arrow Lakes	**1**	None	None	None
Isabel Lakes	**1**	None	None	None
Harrison Lake	**1**	None	**Small Population Size** (2.3) Single local population size lower than what may be sustainable or viable (*i.e.*, formerly robust population is now reduced to high single digit redd count over recent decade).	**Nonnative fishes** (3.1) Lake trout invasion within the past ~30 years has seriously reduced bull trout population through unknown mechanisms of competition and/or predation. Documented hybridization with brook trout occurring.
Lincoln Lake	**1**	None	None	**Nonnative fishes** (3.1) Abundant brook trout likely leading to hybridization and competition, but poorly documented.
Upper Stillwater Lake	**1**	None	None	**Nonnative fishes** (3.1) Abundant brook trout population in most of SR habitat. Competing/predating lake trout and northern pike dominate FMO habitat.

<u>**Geographic Region**</u> **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS** ***HABITAT***	**PRIMARY THREATS** ***DEMOGRAPHIC***	**PRIMARY THREATS** ***NONNATIVES***
Upper Whitefish Lake	**1**	**Upland/Riparian Land Management** (1.1) Developed State campground on the lakeshore and outlet; associated multiple user activities affect habitat quality through riparian degradation and sedimentation.	**Fisheries Management** (2.2) Low numbers aggravated by almost certain (though undocumented) bycatch mortality due to high angler use (supported by cutthroat stocking). **Small Population Size** (2.3) Low population (mid-single digit redd count over recent decade) is partially natural due to size of core area but lower than what may be sustainable or viable.	None
Whitefish Lake	**1**	**Upland/Riparian Land Management** (1.1) Residential development (including municipality of Whitefish), roads, and railroad continue to affect habitat quality through riparian degradation, sedimentation, and nutrient enrichment on the lakeshore. The upstream watershed was impacted by roads and logging.	None	**Nonnative fishes** (3.1) Abundant brook trout populations in SR likely leading to hybridization and competition, but poorly documented. Competing/predating lake trout and northern pike dominate FMO habitat.
Hungry Horse Reservoir	**10**	None	None	None
Doctor Lake	**1**	None	None	None
Big Salmon Lake	**1**	None	None	None
Swan Lake	**9**	None	None	**Nonnative fishes** (3.1) Lake trout represent the single largest primary threat to bull trout, overwhelming the FMO habitat in Swan Lake. Lake trout invasion and expansion in the past 20 years, coupled with a robust *Mysis* population from a 1970's introduction, has compromised bull trout survival

<u>Geographic Region</u> **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS** ***HABITAT***	**PRIMARY THREATS** ***DEMOGRAPHIC***	**PRIMARY THREATS** ***NONNATIVES***
				(predation) and introduced competition for a limited prey base (primarily kokanee) available to piscivores. Brook trout have been present in most SR tributaries for a half century or longer, with no documented recent change in status, but in some important SR tributaries (*e.g.*, Lion, Goat) resulting in high documented rates of hybridization. Hybrids are abundant throughout SR and FMO habitat (observed hybrids to 8-10 lbs in Swan Lake), further reducing potential bull trout recruitment.
Lindbergh Lake	**1**	None	None	**Nonnative fishes** (3.1) Lake trout were recently (past 10 years) established in FMO habitat, ostensibly through upstream migration from Swan Lake, with rising predation and competition anticipated. Brook trout population is well established in most of SR habitat.
Holland Lake	**1**	None	**Small Population Size** (2.3) Population size is naturally limited due to size of core area and extremely limited and unstable SR habitat. Redd counts averaged in the teens to low 20's prior to 2000, typically in single digits since. May not remain sustainable or viable in face of nonnative lake trout pressure.	**Nonnative fishes** (3.1) Lake trout were recently (past 10 years) established in FMO habitat, ostensibly through upstream migration from Swan Lake, with rising predation and competition anticipated. Brook trout population is well established in most of SR habitat.

Geographic Region **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS** ***HABITAT***	**PRIMARY THREATS** ***DEMOGRAPHIC***	**PRIMARY THREATS** ***NONNATIVES***
Kootenai Geographic Region				
Kootenai River	**8**	**Upland/Riparian Land Management** (1.1) Forest practices and the ongoing use and management of roads and transportation corridors are impacting most SR tributaries by causing riparian and instream degradation, loss of LWD, and pool reduction. **Instream Impacts** (1.2) Mainstem habitat (FMO in a regulated river) downstream of Libby Dam is affected by lack of flushing flows, gas supersaturation (seasonally and sporadically), erratic instream flow patterns and recent *Didymo* blooms.	None	**Nonnative fishes** (3.1) Brook trout proliferate with high rates of hybridization in some SR tributaries (*e.g.*, O'Brien Creek, Pipe, and West Fisher).
Lake Koocanusa*	**2**	None	None	None
Bull Lake	**1**	**Upland/Riparian Land Management** (1.1) Accessible high quality SR habitat is limited (in part naturally) and appears to be of declining quality in Keeler Creek due to limited gravel recruitment. The riparian zone has been impacted by forest practices and ongoing use and management of roads.	None	**Nonnative fishes** (3.1) Brook trout are proliferating with some evidence of hybridization in the single SR tributary (Keeler Creek). FMO habitat (Bull Lake) is increasingly compromised by expanding populations of nonnative predator species, including recently illegally introduced northern pike, smallmouth bass, and black crappie.

<u>**Geographic Region**</u> **Core Area (Complex)** ***Core Area (Simple)***	**Number of Local Populations**	**PRIMARY THREATS** ***HABITAT***	**PRIMARY THREATS** ***DEMOGRAPHIC***	**PRIMARY THREATS** ***NONNATIVES***
<u>**Coeur d'Alene Geographic Region**</u>				
Coeur d'Alene Lake	**5** **all in St. Joe River headwaters**	**Water Quality** (1.3) Poor water quality in the mainstem Coeur d'Alene R. FMO habitat (temperature, metals, oxygen) and in the St. Joe R. FMO habitat (temperature and low levels of DO) impacts migratory capability. This combines with some habitat limitations (loss of pools and instream cover) to create relatively hostile conditions in the migratory corridor.	**Small Population Size** (2.3) Low population size and lack of replication of stable populations in the St. Joe R. (no bull trout remain in the Coeur d'Alene R. system) limits recovery potential, despite a relatively expansive FMO habitat in Coeur D'Alene Lake.	**Nonnative fishes** (3.1) Northern pike, smallmouth bass, and possibly Chinook salmon in FMO habitat (lake and mainstem migratory corridor) are relatively certain to be limiting survival of juvenile/subadult migratory bull trout.

Habitat Threats

Complex Core Areas: Habitat threats are considered primary in 10 of the 15 complex core areas in the CHRU (Table D-2) and are especially prevalent in managed landscapes with high proportions of private lands. Habitat threats are not primary in the West Fork Bitterroot River, Flathead Lake, Hungry Horse Reservoir, Swan Lake, and Lake Koocanusa core areas where most of the headwaters are on National Forests, and often in protected areas. In 8 of the 10 complex core areas where habitat threats are considered primary, the threats are typically related to forest practices, livestock grazing, and roads and transportation corridor presence and management (*e.g.*, Pierce *et al*. 2008). These activities may cause habitat degradation of riparian zones, sediment delivery that leads to degraded and over-widened stream channels and poor embryo survival, elimination of pool habitat and loss of structure in the form of large woody debris, and other forms of less obvious instream habitat damage.

Agricultural practices, including cropland and irrigation diversions, have contributed to the overall degradation of bull trout habitat in the CHRU by reducing stream flows and increasing sedimentation. Where these activities have or are occurring along smaller streams with spawning and rearing (SR) habitat the impacts may limit juvenile recruitment of migratory bull trout by reducing embryo survival and the interstitial spaces favored by juvenile bull trout. FMO habitat can also be significantly impacted by agricultural practices that cause a reduction in bull trout habitat quantity and suitability by reducing water levels and degrading water quality. These impacts are often felt most directly in core areas dominated by the fluvial life history form (*e.g.*, Upper and Middle Clark Fork River, Bitterroot River, Rock Creek, Blackfoot River, and Kootenai River) where subadult and adult bull trout reside year-around in large streams or rivers.

The impacts of widespread residential development of the riparian habitat (*e.g.*, Bitterroot River core area) are difficult to manage due to the large number and diverse practices of landowners, though they are less pervasive in the CHRU than some other habitat threats. This ever-increasing encroachment on the floodplain, and the subsequent efforts to control bank erosion and modify the riparian vegetation, reduces the natural form and function of rivers by simplifying complex habitat and reducing the amount and quality of habitat. Development in flood plains exacerbates temperature problems, increases nutrient loads, decreases bank stability, and increases pressures to alter stream and riparian habitats. In 2004, a review of the mainstem Bitterroot River (61 miles [98 km]) estimated that approximately 12 percent of the streambanks were armored or otherwise artificially stabilized (Boyd and Thatcher 2008). A primary finding of this study was that the Bitterroot River is a naturally dynamic river, with some lateral bends having migrated distances up to 1,500 feet (460 meters) in the decade between 1995 and 2004. These events were considered beneficial for the recruitment of large woody debris that provides for complex fish habitat and regeneration of woody riparian plant communities.

Regulated rivers which modify the natural hydrograph are part of some core area landscapes (*e.g.*, Kootenai River, Flathead River, Lower Clark Fork, and Pend Oreille Rivers). These systems often lack normal flow patterns, particularly normal flood regimes, and as a result do not transport sediment, experience normal periodic high flow events, or normal temperature regimes. High summer water temperatures in the lower Clark Fork River reservoirs are, however, part of "normal temperature regimes" due in part to the natural warming effect in the South Bay of Flathead Lake and discharge of that warm water into the Flathead River below Kerr Dam. High temperature affects not only bull trout, but also the food chain. Finally, in some portions of the CHRU water quality has been impaired due primarily to historic and current mining activity. Additional mining has been proposed in some portions of the CHRU, with the potential for additional effects.

Riparian habitat trend has been generally improving in SR habitat over the past 25 years or longer on Federally managed timber lands (see, *e.g.*, PACFISH/INFISH Biological Opinion effectiveness monitoring [Archer and Groce 2015]), due in part to recent improvements in management practices, but also as an artifact of declining timber harvest and the virtual cessation of road building on Federal lands (USFS 2013). A multitude of restoration actions have been implemented or planned on National Forest and private timber lands within this recovery unit. In most watersheds occupied by bull trout in the CHRU, the most egregious road and sediment problems have been addressed. However, in many locations the legacy effects of past management will persist for decades. Impacts from livestock grazing and the presence of transportation corridors and residential development in riparian areas also continue unabated, or are even accelerating as human development and urbanization continues. These impacts are felt most strongly in heavily managed landscapes, principally in core areas where the highest percentages of private lands occur. In most such cases, limited standards and guidelines regulate land use or development on private lands. It is important to recognize that while many legacy impacts have been partly or completely rectified since listing (and before), recovery unit-wide numbers of bull trout remain static or often declining, Additional impacts to stream temperatures that may exacerbate or aggravate impacts related to climate change are captured in the climate change discussion (later in this section).

In association with the Service's 5-year review of the bull trout, State fishery managers conducted a comprehensive review of bull trout distribution and abundance and associated it with "site potential" (IDFG and MFWP 2005). These results were summarized by length of habitat occupied. Where field data were available, bull trout abundance was rated based on how similar the measured abundance was to measured abundances from control areas of similar types of habitat that were not impacted by human activities. Where no field data were available, abundance classes were subjective and based, to a large extent, on the quality of the habitats occupied. This assessment was meaningful only for the complex core areas. In general and not surprisingly, bull trout populations were considered mostly "at or above site potential" in complex core areas with large amounts of high quality SR habitat and low nonnative species occurrence, such as Hungry Horse Reservoir, Swan Lake (pre-lake trout), and Lake Koocanusa. Where either habitat or nonnative species threats or both were considered elevated and where more of the habitat was in actively managed status, populations were more often considered "somewhat below site potential" (*i.e.*, Bitterroot River, Clearwater River and Lakes, Rock Creek, and lower West Fork Bitterroot River). In most of the complex core areas in the CHRU, the threats often interact in compounding fashion so that the majority of habitat was considered to be occupied at "substantially below site potential" (*i.e.*, Upper Clark Fork River, Middle Clark Fork River, Blackfoot River, Lake Pend Oreille A, B, and C; Flathead Lake, Priest Lakes, Kootenai River, and Coeur d'Alene Lake).

Simple Core Areas:

The number of simple core areas with primary habitat threats is low. However, Whitefish Lake (Flathead geographic region) and Bull Lake (Kootenai geographic region) are lower elevation systems surrounded by intense human activity on largely private shorelines and have had intensive management activity in their watersheds. Because most simple core areas in the CHRU exist in headwaters on Federal lands and many are protected in National Parks and Wilderness Areas, these systems are considered particularly sensitive to additional human-caused habitat impacts. Unlike complex core areas, simple core areas are dependent on a single SR stream, and populations are typically much smaller, leaving them more sensitive to threats and heightening concerns about direct impacts to habitat.

Demographic Threats

Demographic threats include actions or conditions that impair connectivity or cause direct loss of individuals, potentially resulting in unacceptably small population size, which can lead to genetic or demographic bottlenecks. The effect on population size of the fragmentation of SR habitat into isolated patches, or a reduction in range or distribution of FMO habitat can be aggravated by dewatering or by entrainment of juvenile and adult bull trout in diversions of irrigation or hydro projects. Limitation of connectivity was identified as a primary threat in many of the fluvial core areas previously described under habitat threats (*e.g.*, Upper Clark Fork River, Bitterroot River, and Rock Creek).

Demographic threats are also a major issue in the largest complex core area, Lake Pend Oreille, where a series of five mainstem dams has essentially dissected the core area into three largely disconnected parts (LPO-A, LPO-B, and LPO-C). Lake Pend Oreille has the highest number of local populations (n = 35) and some of the best cold water adfluvial FMO habitat in the CHRU, but major portions of the Lake Pend Oreille watershed are tenuously connected (for purposes of migration) to most of the watershed due to the dams. The movement of adult bull trout upstream from Lake Pend Oreille to at least nine local populations in Montana (97.2 percent of the watershed) was blocked by Thompson Falls Dam in 1913. Construction of Cabinet Gorge Dam in 1952 blocked access to an additional six local populations in Montana tributaries. Since 2001, connectivity and successful spawning (DeHaan and Bernall 2013) has been partially achieved by a capture and transport program instituted by Avista, moving an average of 36 adult bull trout (range 19-63) upstream to natal spawning tributaries from which they either originated or were genetically assigned. However, it is anticipated that these numbers will increase with construction of a capture and transport fish passage facility at Cabinet Gorge Dam, currently pending regulatory approval. Later construction of a similar facility at Noxon Rapids Dam is being planned, pending resolution of fish pathogen concerns and building upon evaluation of the Cabinet Gorge fish passage facility. Connectivity impairment caused by mainstem dams is just one of many factors potentially affecting bull trout populations. Widespread natural/glacial intermittency also isolates SR habitat in LPO-A streams (Sando and Blasch 2015) and influences bull trout life history (Zymonas 2006).

A fully functional full-height fish ladder was completed at Thompson Falls Dam in 2011 and is passing about 5,000 total fish per year upstream (Northwestern Energy 2015). However, because the numbers of bull trout in the system are so low, only one or two bull trout use the ladder to move upstream annually.

Downstream of Lake Pend Oreille, in the Pend Oreille River drainage of northeast Washington, bull trout were largely eliminated through a combination of fragmentation and habitat impacts (Geist *et al*. 2004, Scholz *et al*. 2005). Restoration actions are underway in most tributaries. Construction of an upstream passage facility is scheduled to begin in late 2015 at Box Canyon Dam. A downstream facility at Box Canyon Dam is planned for construction shortly after completion of the upstream facility. Currently, a temporary Denil trap is installed at Albeni Falls Dam to provide selective upstream fish passage and most bull trout captured downstream of the dam during sampling and other management activities are trucked upstream. A permanent upstream passage facility at Albeni Falls Dam is proposed, but yet to be funded. Historically, prior to Albeni Falls Dam construction, as many as eight local populations of bull trout existed downstream of the site (Appendix I) (USFWS 2002, USFWS 2010a). However, it is likely that all of these local populations are now extirpated （USFWS 2008a）. Reintroduction of self-sustaining populations is a primary goal of area stakeholders and partners. Once two-way passage is available downstream of Box Canyon and Albeni Falls Dams, recolonization is more likely. However, Dunham *et al*. (2014) anticipated that even then some level of translocation and reintroduction will be necessary to establish populations at sustainable levels.

Small population size is cited as a primary threat in a few core areas, or portions thereof with fragmented local populations (Table D-2). Monitoring in these areas typically locates a number of bull trout redds in the low single digits (five or fewer), sometimes with entire year class failures. We are uncertain as to whether, even with improving conditions, these populations can sustain themselves and whether a genetic bottleneck has already occurred, reducing the genetic viability of these populations. Determination of genetic viability carries significant scientific uncertainty, but should be considered a red flag for persistence (Whitesel *et al*. 2004). Where small populations and low redd counts occur in simple core areas, potential extirpation of genetically valuable resources is at stake.

In a few cases (*e.g.*, Flathead Lake, Logging Lake, and Upper Whitefish Lake) angling impacts (typically catch and release mortality) and past fisheries management sampling activities or aggressive gillnetting to remove nonnative lake trout, in concert with very weak stocks or local populations of bull trout, may lead to the potential unintended extirpation of those populations. Concerns expressed by stakeholders were sufficient to elevate this issue to primary threat status in a few core areas.

When assessing whether threats are being effectively managed within a core area (Threats Assessment Tool in Appendix E of the bull trout recovery plan), relevant data on population indices and trends are valuable for determining whether small population size is a threat under Listing Factor E, and for assessing over time whether management actions are effective in mitigating the impact of other threats. Genetic viability and expression of migratory life histories within complex core areas requires sufficient population size, as well as connectivity among suitable tributary streams. Therefore, in all complex core areas we have identified the acquisition and incorporation of population survey data into threats assessments as a conservation recommendation.

Nonnative Species Threats

Nonnative fishes constitute the single most often cited primary threat in core areas throughout the CHRU. Lake trout, a congeneric species whose niche has strong overlap with bull trout, can outcompete and prey on bull trout in lacustrine (lake) habitat. Lake trout occasionally occupy some of the mainstem riverine environments that are FMO habitat for bull trout. The lake trout is the nonnative species of greatest concern threating bull trout (Martinez *et al*. 2009, Hansen *et al*. 2010, CSKT 2014). Lake trout are cited as the dominant primary threat in 3 of 15 complex core areas (*i.e*., Priest Lakes, Flathead Lake, and Swan Lake), and 8 of 20 simple core areas (*i.e*., Bowman Lake, Quartz Lakes, Lower Quartz Lake, Logging Lake, Harrison Lake, Whitefish Lake, Upper Stillwater Lake, Lindbergh Lake, and Holland Lake), which together include nearly half of the CHRU landscape (USFWS 2010c). Lake trout have expanded within the CHRU since the time of listing (1998). The expansion of lake trout shows no signs of abating in numerous core areas, though there has been some notable successful management with gillnet suppression efforts in Lake Pend Oreille, Upper Priest, and Quartz Lakes (Hansen *et al*. 2010, Wahl *et al*. 2013, Ryan *et al*. 2014, Fredenberg 2015).

Brook trout represent another threat to bull trout populations. The brook trout is a congeneric species that competes with, and can hybridize with, bull trout. Fluvial bull trout core areas are more likely to be influenced by the widespread distribution and abundance of brook trout (*e.g.*, Upper and Middle Clark Fork River, Bitterroot River, Rock Creek, Blackfoot River, and Kootenai River core areas). Brook trout seldom occupy larger lakes in the CHRU in numbers sufficiently high to represent a threat and are not considered likely to be a threat in most FMO habitat. However, because most adfluvial populations of bull trout are still dependent on SR habitat in their headwater tributaries, significant loss of habitat capacity and productivity can occur as a result of competition from brook trout in these tributaries (Gunckel *et al*. 2002, McMahon *et al*. 2007, Rich *et al*. 2003, Rieman *et al*. 2006, Warnock 2012). Competition from brook trout and their hybrids also occurs in SR habitat in a number of adfluvial complex core areas (*e.g.*, West Fork Bitterroot River, Clearwater River and Lakes, Swan Lake, Priest Lakes, upstream and downstream portions of Lake Pend Oreille) as well as some simple core areas (*e.g.*, Lincoln Lake, Upper Stillwater Lake, Whitefish Lake, Lindbergh Lake, Holland Lake, and Bull Lake). Only 4 of the 15 complex core areas in the CHRU where brook trout are either relatively uncommon (Flathead Lake, Lake Koocanusa, and Coeur d’Alene Lake) or absent (Hungry Horse Reservoir) from SR habitat are considered to be relatively uncompromised by brook trout. In the case of Coeur d’Alene Lake brook trout are widespread but mostly considered a reduced threat because the range of bull trout has been dramatically reduced from historic levels.

Lake Pend Oreille merits separate discussion from a nonnative fish threat perspective. Lake Pend Oreille is the largest and most diverse core area, covering 4.46 million acres (1.80 million hectares), with 8,276 miles (13,319 km) of mapped streams, 35 bull trout local populations, and 5 major systemic barriers (Box Canyon, Albeni Falls, Cabinet Gorge, Noxon Rapids and Thompson Falls Dams). The reservoirs contain suboptimal cold water habitat that support abundant populations of coolwater and warmwater introduced fish.

The Lake Pend Oreille basin proper and its remaining connected tributaries that are not blocked by major dams (LPO-B in Table D-2) cover 0.67 million acres (270,000 hectares) with 1,250 miles (2,000 km) of mapped streams (representing 15 percent of the total Lake Pend Oreille core area). The bull trout population is relatively robust in this area (approximately 12,000 fish; see, *e.g.*, Vidergar 2000, McCubbins 2013) despite loss of connectivity to large areas of upstream and downstream SR habitat. The strong population is largely due to the high quality of the FMO habitat in Lake Pend Oreille and presence of a quality forage fish community, supported by nonnative kokanee. However, bull trout numbers in Lake Pend Oreille were likely higher prior to the construction of the dams and the establishment of nonnative species that compete with, or prey on, bull trout.

Several nonnative species occupy the disconnected portions of the formerly contiguous Lake Pend Oreille core area upstream of Cabinet Gorge Dam (LPO-A, Table D-2) and downstream of Albeni Falls Dam (LPO-C, Table D-2) compete with and prey upon bull trout. Nearly two-thirds of the Lake Pend Oreille core area (*i.e*., LPO-A = 59 percent of area or 2.64 million acres (1.07 million hectares), with 5,269 miles (8,480 km) or 64 percent of the mapped streams) is upstream of Cabinet Gorge Dam in Montana. The remaining 1.14 million acres (460,000 hectares) (26 percent of area) is downstream of Albeni Falls Dam in the lower Pend Oreille River and northeast Washington (LPO-C), with 1,757 miles (2,828 km) (21 percent) of the mapped streams. Brook × bull trout hybrids and redd superimposition by brown trout have been documented, though not widespread, in the LPO-A portion of the core area. Northern pike are also abundant in Thompson, Noxon, and Cabinet Gorge (Bernall and Moran 2005) reservoirs (LPO-A) and downstream in LPO-C (Bean 2014). Expanding walleye populations in Noxon Reservoir and Lake Pend Oreille proper have also been documented and are under study for the potential threat they may pose.

Northern pike are abundant in the Flathead River upstream of Flathead Lake and in shallower bays of Coeur d'Alene Lake, including the lower Coeur d'Alene and St. Joe River, portions of which are bull trout migratory corridors. A study of the mainstem Flathead River (Muhlfeld *et al*. 2008) documented predation by northern pike on bull and westslope cutthroat trout and concluded the northern pike population consumed over 13,000 westslope cutthroat trout and nearly 3,500 bull trout annually. Their results suggested that predation by introduced northern pike was contributing to the lower abundance of native salmonids in this system. Schmetterling (2000) set gillnets in Milltown Reservoir on the upper Clark Fork River mainstem upstream of Missoula, and found 9 bull trout in 24 pike stomachs during early May, 2000. Milltown Dam has since been removed. Northern pike are also abundant in lotic habitat of simple core areas of Upper Stillwater Lake, Whitefish Lake, and Bull Lake (Kootenai). While no specific studies have been conducted in these areas, we suspect similar impacts to the already low bull trout populations in these systems.

Climate Change Threat

As mentioned, the CHRU is somewhat unique in that most core areas are tied to lacustrine (lake) systems where the bull trout exhibit an adfluvial life history form. Bull trout in 9 of 15 complex core areas (60 percent) and all 20 of the simple core areas are directly tied to lacustrine FMO habitat where subadults and adults spend the majority of their lives. While depth distribution and periodicity of lake stratification may change with climate change effects, with exception of a few of the shallower lakes that are at lower elevation (*e.g.*, Cyclone Lake, Bull Lake, and Upper Stillwater Lake), the persistence of cold water sanctuaries in most lake FMO habitat is unlikely to be markedly affected by even the more extreme climate change scenarios predicted over the next 25 years.

For some of the fluvial core areas (*e.g.*, Upper and Middle Clark Fork River, and Bitterroot River) the impact of climate change on peak summer water temperatures in the FMO habitat is likely to be more dramatic. The temperature tolerance of adult bull trout is less rigid than juveniles and complicated thermal regimes occur in many mainstem rivers. Rivers in the CHRU are often fed by colder tributaries, especially in the headwaters, and these mixing areas provide thermal refugia during the warmer seasons. Larger bull trout are capable of migrating, sometimes long distances, to find appropriate temperature conditions. Juvenile bull trout are more sensitive to thermal conditions in SR habitat where they occur.

We used the recent Climate Shield model by Isaak *et al*. (2015) to evaluate the threat from climate change in the watersheds occupied by bull trout in the CHRU. The model predicts peak summer temperature in watersheds throughout the range of the bull trout. The Climate Shield model couples nearly 30,000 crowd-sourced summer water temperature measurements from a diverse array of agencies and institutions across over 10,000 unique stream locations to mathematically assess stream temperatures and forecast future scenarios (Isaak *et al*. 2015). By analyzing these data sets, high-resolution networks of cold water refugia can be predicted and evaluated.

The Climate Shield model is useful for bull trout recovery planning at a landscape scale. Because it is based on large data sets, the model allows us to look strategically within watersheds at areas where cold water patches of habitat may persist and identify areas that will likely support bull trout spawning and rearing in the future. Conversely, we can also identify watersheds where they are likely to disappear, and where unoccupied patches or patches with unknown bull trout occupancy deserve further assessment and evaluation as potential refugia in the future.

The CHRU has a large number of simple core areas centered within lakes, some of which are quite large and most of which were carved by the Wisconsin glaciation. The Climate Shield model results indicate that very few of those lakes are linked to large cold water patches of upstream habitat. Many of these core areas might not even support bull trout today were it not for the cold water refugia the lakes provide during summer.

The value of deep cold water systems is further emphasized by the “reservoir” effect. Some dams have created large artificial lakes filled with cold water, where the adfluvial life history form of bull trout now thrives (*e.g.*, Lake Koocanusa on the Kootenai River, Hungry Horse Reservoir on the South Fork Flathead River, and Painted Rocks Reservoir on the West Fork Bitterroot River). In the case of Lake Koocanusa and Painted Rocks Reservoir, the main bull trout life history form prior to the dam’s construction was fluvial. The transition to a primarily adfluvial existence demonstrates the phenotypic and life history plasticity that bull trout and other *Salvelinus* species exhibit. In addition, there are many sites where smaller thermal refugia or pools created by dams may provide habitat that meets some or all of the habitat conditions required by adult and subadult bull trout, thus increasing survival and potentially enhancing the population's status (*e.g.*, East Fork Dam on East Fork Rock Creek). The potential benefits of cold water refugia in some reservoirs should not be ignored in light of the potential for an increasingly warm environment due to climate change in the future that may be hostile to bull trout. This does not mean that dams are universally or wholly beneficial. Dams that fragment large systems formerly occupied by fluvial or adfluvial bull trout into a number of smaller systems, may threaten downstream bull trout populations (*e.g.*, Hungry Horse Reservoir fragmented the Flathead Lake population). There are dozens, if not hundreds of dams and diversions in the CHRU that may block upstream migratory passage, entrain bull trout, provide shallow-water sanctuaries for nonnative predators or competitors, create thermal traps, or otherwise fragment connectivity in formerly contiguous systems (*e.g.*, Thompson Falls, Noxon Rapids, Cabinet Gorge, Albeni Falls, and Box Canyon dams on the Clark Fork River). In the CHRU, both the potentially positive as well as demonstrably negative aspects of dams and reservoirs are considered individually at the core area level.

The most useful current application of the Climate Shield model is to examine the presence and potential persistence of cold water patches. Juvenile bull trout are rarely found in streams where mean summer water temperatures exceed 12 degrees Celsius (54 degrees Fahrenheit) (Isaak *et al*. 2010, Dunham *et al*. 2014). The Climate Shield model uses a mean August water temperature of 11 degrees Celsius (52 degrees Fahrenheit) to delimit the downstream extent of cold water habitat for modeling purposes (Isaak *et al*. 2015). Spatially contiguous 1-km (0.6-mile) reaches of streams that are wider than 1 meter (3.3 feet) and have less than 15 percent slope were considered suitable cold water patches for potential bull trout occupancy under the model (Isaak *et al*. 2015). Based on the model parameters, we mapped cold water habitat patches with occurrence probabilities greater than 50 percent (likely occupied) and 10 to 49 percent (potentially occupied) at the level of the core areas (n=35). Nearly all simple core areas (n =20) contain minimal amounts (less than 10 km [6 miles]) of upstream cold water habitat. These systems typically exist in steep glaciated headwaters, and the model was essentially ineffective at predicting future changes at that scale. For the 15 complex core areas, habitat is more expansive and each SR tributary as well as the associated FMO habitat have unique attributes and characteristics.

Based on comparison to existing distribution information, we determined that the 1980 Climate Shield model scenario (baseline) was an overly optimistic projection of bull trout occupancy. It may accurately represent conditions prior to human impacts on the systems and before the nonnative fish invasion, but it did not appear to accurately reflect the current distribution when compared to our "known occupancy" layer. The "known occupancy" layer (USFWS 2010c) was developed by the Service using Montana Fish, Wildlife, and Parks (MFWP, MFish data) and Idaho Department of Fish and Game (IDFG) known occurrence data from field surveys (primarily electrofishing). Professional judgment was used to stitch together disconnected units. The known occupancy layer attempted to define the border between SR and FMO habitat. Typically SR habitat was considered to extend in each spawning tributary (*i.e*., local population) from as far upstream as juvenile occupancy was known or suspected down to the junction with a mainstem river where mixing of stocks and adult migratory populations commonly occurs (considered FMO habitat). We used the 2040 and 2080 Climate Shield model projections of suitable juvenile habitat as our base for future cold water patches (Isaak *et al*. 2015). We compared and contrasted these model results with the 2010 known occupancy layer (USFWS 2010c). We then derived the following set of comparisons, by core area.

Table D-3 shows the size of the 15 complex core areas (U.S. portion only) and compares them to the stream network (USGS hydrography) and bull trout habitat layer (USFWS 2010c). Table D-3 illustrates that even in highly connected headwater basins in the CHRU (*e.g.* Rock Creek, Hungry Horse Reservoir, and West Fork Bitterroot), bull trout SR habitats typically occupy much less than one-third of the hydrography. Overall, only 8.7 percent of the total stream length is currently occupied bull trout SR habitat in the CHRU. The largest core areas contain the most spatially diverse habitats, include the longest migratory corridors (designated as FMO habitat), and typically support bull trout in a lower percentage of their hydrography.

Table D-3 also compares the 2010 mapped bull trout occupancy layer (USFWS 2010c) to the extent of habitat considered likely to be occupied by bull trout in 2040 based on the cold water Climate Shield model (*i.e*., occurrence probability greater than 0.50, mean summer water temperature less than 11 degrees Celsius [52 degrees Fahrenheit]). The current analysis simply accounts for stream distances mapped from the two sources, but does not assess their degree of overlap. That issue is discussed in more detail later. For the most part, the mapping of occupied SR habitat (USFWS 2010c) did not extend into first-order tributaries nor upstream of known natural fish barriers, whereas the climate-shield mapping of likely habitat (occurrence probability greater than 0.50) incorporates portions of those steeper headwaters (up to 15 percent gradient) and includes barriered watersheds (*i.e*., based on presence of cold water). The total amounts of habitat between the 2010 occupied habitat layer and the 2040 Climate Shield model output are similar, with roughly 5,000 km (3,000 miles) in each.

In five complex core areas (Kootenai River, Bitterroot River, Middle Clark Fork River, Priest Lakes, and Clearwater Lakes) the spatial extent of habitat considered likely to be suitable for occupancy in 2040 is less than 40 percent of that currently considered occupied (see Table D-3, Column 7; Ratio 2040 Likely to 2010 Occupied = 0.25 to 0.39). In seven primary core areas (*i.e*., Lake Pend Oreille, Hungry Horse Reservoir, Rock Creek, Swan Lake, Coeur d'Alene Lake, West Fork Bitterroot River, and Lake Koocanusa) the 2010 occupied habitat layer and the 2040 Climate Shield model output contain similar amounts of habitat (ratio 0.69 to 1.24). On the other end of the scale, the 2010 occupied habitat layer (USFWS 2010c) in the Flathead Lake, Blackfoot River, and Upper Clark Fork core areas is mapped at much less than the density anticipated from Climate Shield projections based on cold water (ratio 1.48 to 1.64). Some of the latter discrepancies are due to large natural barriers that historically precluded bull trout from colonizing or persisting in certain large cold water patches upstream, though these are still identified as having a high probability of occupancy in the Climate Shield model (*e.g.*, North Fork Blackfoot River upstream of North Fork Falls; Spotted Bear River upstream of Dean Falls).

When we projected the Climate Shield model even further into the future, from 2040 to 2080 (based on A1B emissions scenario represented by an ensemble of 10 global climate models; see Isaak *et al*. [2015]), the habitat patches modeled as cold enough to still be likely occupied by bull trout (occurrence probability greater than 0.50) shrink by nearly 50 percent, from 4,711 km (2,927 miles) down to 2,508 km (1,558 miles) (Table D-3; last column). For recovery planning purposes, the specific numerical values are not as important as the projected aggregate loss of bull trout SR habitat for the CHRU (approximately 47 percent). The relationship among core areas and the relative rate of shrinkage of available SR habitat within individual core areas is important.

The projected relative decline in potentially suitable bull trout SR habitat (*i.e.*, cold headwater stream habitat) between 2040 and 2080 is highest in Coeur d'Alene Lake (97 percent), Kootenai River (80 percent), Lake Pend Oreille (68 percent), Middle Clark Fork River (63 percent), and Bitterroot River (60 percent) complex core areas. The Swan Lake (53 percent), the Blackfoot River (52 percent), Rock Creek (44 percent), Priest Lakes (43 percent), and Hungry Horse Reservoir (41 percent) core areas are projected to retain roughly half of the cold water habitat compared to the 2040 model output. The least significant decline in cold water habitat between 2040 and 2080 projections is in the Upper Clark Fork (35 percent), West Fork Bitterroot (35 percent), Clearwater Lakes (35 percent), and Flathead Lake (31 percent) core areas. While this may not translate directly to probability of persistence, it should nonetheless be viewed as an important indicator of potential habitat loss. Over one-fourth (27 percent) of the cold water habitat projected to remain by 2080 is found in the Flathead Lake core area. Collectively Flathead Lake, Hungry Horse Reservoir, and the Blackfoot River core areas are projected to contain over 50 percent of the suitable cold water SR habitat for bull trout by 2080 in the CHRU (Table D-3). Arguably, this is compelling evidence that those three core areas comprise very important bull trout SR habitat that should be protected as a highest priority in the CHRU.

Table D-3. Fifteen complex core areas of the Columbia Headwaters Recovery Unit (in descending order of size by drainage area), with comparison(s) of total stream system length and mapped current bull trout occupancy (USFWS 2010c), to the habitat modeled as potentially suitable for future occupancy (2040 and 2080), based on the Climate Shield model (Isaak *et al*. 2015). Higher ratios may indicate current level of occupancy is more likely to persist in future scenarios, while lower ratios likely indicate greater decline in potentially suitable habitat.

CORE AREA	Drainage Area (ha)	Total Stream Length (km)	2010 Occupied Bull Trout SR Habitat (km)	% of Stream Length Occupied 2010	2040 Likely Occupied (km)	Ratio 2040 Likely to 2010 Occupied	2080 Likely Occupied (km)	Ratio 2080 Likely to 2010 Occupied	% Decline 2040 Likely to 2080 Occupied
Lake Pend Oreille	1,803,460	13,319	580.7	4.4	432.6	0.74	139.4	0.24	68.0
Coeur d'Alene L.	1,025,347	7,237	204.0	2.8	140.8	0.69	4.7	0.02	97.0
Flathead Lake	937,369	6,434	639.1	9.9	976.3	1.53	672.8	1.05	31.0
Upper Clark Fork	724,362	6,080	285.1	4.7	422.5	1.48	276.0	0.97	35.0
Kootenai River	712,197	5,272	316.0	6.0	93.3	0.30	19.0	0.06	80.0
Bitterroot River	657,228	5,388	880.7	16.3	280.3	0.32	112.1	0.13	60.0
Blackfoot River	513,765	5,221	415.6	8.0	681.2	1.64	325.6	0.78	52.0
Middle Clark Fork	512,113	3,710	456.7	12.3	113.7	0.25	41.7	0.09	63.0
Hungry Horse Res.	404,996	2,737	422.3	15.4	522.5	1.24	310.5	0.74	41.0
Lake Koocanusa	316,140	2,210	141.6	6.4	136.0	0.96	87.5	0.62	36.0
Rock Creek	229,979	1,925	397.0	20.6	376.4	0.95	210.6	0.53	44.0
Swan Lake	176,384	1,395	241.5	17.3	200.5	0.83	93.8	0.39	53.0
Priest Lakes	152,389	999	140.3	14.0	54.4	0.39	31.2	0.22	42.6
Clearwater Lakes	85,430	628	166.0	26.4	43.8	0.26	28.5	0.17	35.0
West Fork Bitterroot	81,458	592	199.7	33.7	236.6	1.18	154.9	0.78	35.0
TOTAL	**8,332,617**	**63,147**	**5,486.3**	**8.7**	**4,710.8**	**0.86**	**2,508.2**	0.46	**46.8**

We conducted a similar type of analysis comparing the number of patches of SR habitat. As previously discussed, a “patch” is described as any spatially contiguous 1-km (0.6-mile) reach of stream greater than 1 meter (3.3 feet) wide and with less than 15 percent slope (Isaak *et al*. 2015). Analysis of the 2010 occupied habitat layer (USFWS 2010c) indicates there are 543 patches of occupied cold water SR habitat in the CHRU. The Climate Shield model projected 161 potentially occupiable patches (occurrence probability greater than 0.50) in the CHRU by 2040. This shrunk by 31 percent, to 110 patches, under the 2080 Climate Shield model scenario. As with the total projected amount of likely occupiable stream habitat, discussed above, the pattern of shrinkage is dramatic in those core areas previously identified as at highest risk (*i.e*., Coeur d’Alene Lake, Kootenai River, Middle Clark Fork River, Priest Lakes, and Clearwater Lakes). Each of these core areas is projected to have only one or two patches of suitable remaining SR habitat by 2080. This analysis confirms that those complex core areas are at risk of being simplified to core areas dependent upon a single local population, even though each core area currently has between 4 and 10 local populations and occupies substantial portions of the landscape.

The Climate Shield model projections do show relative encouragement for 10 core areas, where a minimum of 4 patches and as many as 16 patches of cold water habitat are expected to persist in the 2080 scenario. Thus, we conclude potentially suitable habitat will be available to support long-term persistence in multiple local populations in 10 of the 15 primary core areas, at least based on the presence of cold water. However, these are only model projections. The 110 cold water patches that are projected to persist in the 2080 model scenario should be individually evaluated, first to determine the proportion with current presence of bull trout (*e.g.*, some projected suitable patches are unoccupied by bull trout as they are upstream of barriers). Occupied patches that are projected to persist should become high priorities for recovery planning and long-term habitat protection. However, climate change is only one threat and final priorities should also consider other threats, such as nonnative fish.

Table D-4 examines the degree of overlap between SR habitat that is currently considered occupied and the habitat projected by the Climate Shield model to persist in cold water patches in 2040 and 2080. Of the 4,711 km (2,928 miles) of habitat considered likely to be suitable for occupancy according to the Climate Shield model (based on water temperature suitability, stream size and slope, (occurrence probability greater than 50 percent), only 1,362 km (846 miles) (29 percent) overlaps with the current map of occupied SR habitat. There are many possible reasons for these discrepancies. Some of the projected suitable SR habitat may, in fact, be occupied but occurs in locations where distribution has not been well documented (*e.g.*, portions of the Bob Marshall Wilderness in the Hungry Horse Reservoir core area are known to be underrepresented in the 2010 mapping). This creates an opportunity going forward for highlighting additional survey needs (*e.g.*, tasks to improve distribution mapping, perhaps by systematically employing the new e-DNA techniques). In other cases, even though a stream meets the size and slope criteria to be considered suitable within the model framework (greater than 1 meter [3.3 feet] width, less than 15 percent slope), and it may contribute cold water to a downstream patch, circumstances may not allow bull trout to access, or persist in, the patch due to geologic barriers, natural dewatering, extreme winter icing or other factors. Some of the larger isolated patches may present opportunities for translocation or range expansion, especially in watersheds occupied by bull trout downstream of the barrier location. Finally, some projected suitable SR habitat, especially in the lower portions of watersheds, may function primarily as a migratory corridor and be occupied only seasonally or sporadically by juvenile bull trout.

In total, only about 29 percent of the habitat modeled as likely to be occupied in the 2040 model run is currently known or considered to be occupied by spawning and rearing bull trout. In most of the complex core areas, roughly one-third to one-half of habitat considered suitable in the 2040 Climate Shield model output is currently occupied (Table D-4). The overlap is somewhat lower in Lake Pend Oreille (14.5 percent), Blackfoot River (16.0 percent), Hungry Horse Reservoir (19.2 percent), Priest Lakes (23.5 percent) and the Upper Clark Fork River (23.7 percent) core areas. Reasons for those potential deficiencies needs to be further examined. For example, in the case of the Lake Pend Oreille core area, the low percentage of occupied SR habitat is likely due, in part, to model layers consistently overestimating the amount of "occupiable" habitat, particularly for lower stream reaches due to stream temperatures, but also for upper stream reaches due to barriers and stream intermittency.

Despite the fact that Climate Shield model projections of suitable habitat decline by nearly half between 2040 and 2080 (Table D-3, above), still only about 28 percent of the habitat modeled as likely to be occupied in the 2080 model run is currently known to be occupied by spawning and rearing bull trout (Table D-4). This is virtually unchanged from the 2040 rate of 29 percent (Table D-4). In most complex core areas, roughly one-third to one-half of habitat considered suitable in the 2080 Climate Shield model output is currently occupied (Table D-4). The overlap is again somewhat low in Lake Pend Oreille (16.5 percent), Blackfoot River (16.8 percent), and Hungry Horse Reservoir (17.9 percent), and the Upper Clark Fork River (22.4 percent) core areas. In the core area with lowest amount of remaining habitat, Coeur d'Alene Lake, there was virtual 100 percent occupancy of the single patch of cold water habitat (4.7 km [2.9 miles]) that is projected to remain by 2080.

While these metrics are useful in comparing projected changes over time, caution is needed when applying them at the core area level. Each core area has specific dynamics and watershed attributes that makes it unique. For example, the Lower Clark Fork River and LPO core areas are projected to be vulnerable to reduced snowpack and increased incidence of rain-on-snow events due to their lower elevation and the influence of maritime climate. This shift would likely affect bull trout spawning and rearing habitat and migratory FMO habitat through reduced stream flow and warmer water in the summer and reduced reproductive success due to winter high flow events. Fine-scale assessments of occupied versus modeled cold water habitat should be conducted at the core area scale to help in the application of individualized recovery tasks related to climate.

As previously noted, nearly all simple core areas (n =20) contain minimal amounts (less than 10 km [6 miles]) of upstream cold water habitat. These systems typically exist in steep glaciated headwater basins and the Climate Shield model is essentially ineffective at predicting the impacts in such cases. The existence of the lakes themselves provides a strong mechanism of bull trout population support in the face of climate change. The maintenance of cold water refugia is an important adaptive strategy in the CHRU, especially where reservoirs are involved. The nine complex core areas based on large lakes (West Fork Bitterroot [Painted Rocks Reservoir], Clearwater Lakes, Swan Lake, Hungry Horse Reservoir, Flathead Lake, Lake Pend Oreille, Priest Lakes, Lake Koocanusa, and Coeur d'Alene Lake) are likely to have higher resiliency, as long as adequate upstream SR habitat is protected and nonnative species impacts are managed. The risks from climate change are greater to the six complex core areas without such refugia (Upper Clark Fork River, Rock Creek, Bitterroot River, Blackfoot River, Middle Clark Fork River, and Kootenai River).

Table D-4. **Fifteen complex core areas of the Columbia Headwaters Recovery Unit (listed in descending order of size by drainage area), with comparison(s) of overlap between current bull trout spawning and rearing habitat occupancy (USFWS 2010c), to the habitat modeled as potentially suitable for future SR occupancy (2040 and 2080), based on the Climate Shield model (Isaak *et al*. 2015).**

CORE AREA	2010 Occupied Bull Trout SR Habitat (km)	2040 Likely Occupied (km)	Overlap 2010-2040 (km)	% of 2040 Likely Occupied in 2010	2080 Likely Occupied (km)	Overlap 2010-2080 (km)	% of 2080 Likely Occupied in 2010
Lake Pend Oreille	580.7	432.6	62.6	14.5	139.4	23.0	16.5
Coeur d'Alene L.	204.0	140.8	57.8	41.1	4.7	4.7	100.0
Flathead Lake	639.1	976.3	339.4	34.8	672.8	237.4	36.6
Upper Clark Fork	285.1	422.5	100.2	23.7	276.0	61.9	22.4
Kootenai River	316.0	93.3	32.9	35.3	19.0	8.3	43.7
Bitterroot River	880.7	280.3	112.3	40.1	112.1	34.0	30.3
Blackfoot River	415.6	681.2	109.2	16.0	325.6	54.6	16.8
Middle Clark Fork	456.7	113.7	60.1	52.9	41.7	19.0	45.6
Hungry Horse Res.	422.3	522.5	100.2	19.2	310.5	55.6	17.9
Lake Koocanusa	141.6	136.0	45.6	33.5	87.5	20.3	23.2
Rock Creek	397.0	376.4	133.7	35.5	210.6	77.6	36.8
Swan Lake	241.5	200.5	81.1	40.4	93.8	25.9	27.6
Priest Lakes	140.3	54.4	12.8	23.5	31.2	11.4	36.5
Clearwater Lakes	166.0	43.8	22.7	51.8	28.5	12.4	43.5
West Fork Bitterroot	199.7	236.6	91.0	38.5	154.9	59.7	38.5
TOTAL	**5,486.3**	**4,710.8**	**1,361.8**	**28.9**	**2,508.2**	**705.8**	**28.1**

Ongoing Columbia Headwaters Recovery Unit Conservation Measures

During the 20th century increasing economic and societal importance has been placed on trout and trout fishing, water-based recreation and water quality in most of the CHRU. Generally low human population density has favored a somewhat benevolent attitude toward protection of much of the habitat where bull trout thrive. Some of the negative effects of past resource extraction activities from a century or more ago (*e.g.*, Butte and Anaconda copper mines, Coeur d'Alene River basin silver and other metal mines) are slowly being remediated. Since the 1998 Federal listing of bull trout, conservation measures have become more focused on bull trout habitat and continue to be implemented within the CHRU. These measures are being undertaken by a wide variety of local and regional partnerships, including State agencies, State and Federal land management and water resource agencies, Tribal governments, power companies, watershed working groups, nongovernmental organizations, water users, and landowners. Unlike some other recovery units where bull trout conservation measures incorporate or are closely interrelated with aquatic protection measures being driven by recovery of salmon and steelhead, there is no anadromous fish overlap with the CHRU. However, large tracts of public land, much of which is protected in wilderness areas, national parks, or other conservation designations, provides some measure of refugia status, at least from human habitat development. In major portions of the CHRU, active measures to protect grizzly bears have also been ongoing since the 1970's, resulting in thousands of miles of road closures, culvert removals, and road rehabilitation actions that have reduced sediment and improved security in many SR watersheds (*e.g.*, Flathead National Forest).

Within the Kootenai and Clark Fork geographic regions of western Montana and north Idaho, it is likely that several hundred habitat improvement and fish passage projects benefitting bull trout have been implemented since the time of listing. MFWP and IDFG, in coordination with other State and Federal agencies, Tribes, and private partners, are the primary project managers. These projects are funded by a variety of public and private sources, including EPA Superfund, Clark Fork Natural Resource Damage Program, AVISTA Native Salmonid Restoration Program, Kerr Mitigation, other FERC-related sources including Seattle City Light and Pend Oreille PUD, Bonneville Power Administration, MFWP and IDFG license revenue, Montana's Future Fisheries Improvement Program of 1995, Montana Bull Trout and Cutthroat Trout Enhancement Program of 1999, Federal FRIMA (Fisheries Restoration and Irrigation Mitigation Act) funds, ESA partnership and stewardship grants, U.S. Fish and Wildlife Service Partners for Fish and Wildlife funding, Bring Back the Natives and other sources of U.S. Forest Service funding, and many others.

The Idaho Department of Lands (IDL) also implements conservation measures, particularly replacing fish barriers with road crossings that pass fish, on fish bearing (Class 1) streams and at crossings where fish presence is unknown but fish habitat is present. These projects are generally accomplished in conjunction with IDL's timber sale program where timber sale purchasers are given a development credit for this work. Since at least 1986, under the Idaho Forest Practices Act and the Stream Channel Protection Act, all stream crossings on fish bearing streams must provide for fish passage. The Idaho Forest Practices Act, Title 38, Chapter 13, Idaho Code, pertaining to road construction, reconstruction and maintenance (Rule 040) states: "Culvert installations on fish bearing streams must provide for fish passage." Specific guidelines are found in the Rules Pertaining to Stream Channel Alteration, Title 37, Chapter 03, Idaho Code. Idaho Department of Lands actively replaces fish barriers and over the last 10 years has replaced 31 fish blocking culverts with fish passable structures in the Columbia Headwaters Recovery Unit.

A general list of the types of activities and their focus areas was found in the previous Draft Bull Trout Recovery Plan, in Chapters 3 (Clark Fork River), 4 (Kootenai River), 15 (Coeur d'Alene Lake and 23 (Northeast Washington) (USFWS 2002). These activities were numbered consistently among chapters and outlined, with increasing specificity by tier. The following list, from the 2002 plan, includes goals carried forward in the current RUIP and is presented here, in part because it applies generally and lacks core area specificity.

1 Protect, restore, and maintain suitable habitat conditions for bull trout.

1.1 Maintain or improve water quality in bull trout core areas or potential core habitat.

1.1.1 Reduce general sediment sources. Stabilize roads, crossings, and other sources of sediment delivery. Implement TMDL's (total maximum daily load standards). Priority watersheds include all designated bull trout CH; especially SR habitat. By virtue of formal designation as Critical Habitat (USFWS 2010b), these watersheds automatically receive additional consideration in Section 7 Consultation and permitting actions that have a Federal nexus.

1.1.2 Upgrade problem roads. Increase maintenance of extensive secondary road systems—U.S. Forest Service, Plum Creek Timber Company, and State lands—by increased application of best management practices, with emphasis on remediating sediment-producing hotspots and on maintaining bridges, culverts, and crossings in drainages that support bull trout spawning and rearing. Priority watersheds include all designated bull trout CH; especially SR habitat.

1.1.6 Assess and mitigate nonpoint thermal pollution. Emphasize protection and enhancement of cold groundwater sources.

1.2 Identify barriers or sites of entrainment for bull trout and implement tasks to provide passage and eliminate entrainment (includes instream flow as well as physical barriers).

1.2.5 Remove or replace culverts. Monitor all road crossings for blockages to upstream passage and replace appropriate existing culverts with fish-friendly structures as opportunity arises. Prioritize by critical habitat streams.

1.3 Identify impaired stream channel and riparian areas and implement tasks to restore their appropriate functions.

1.3.1 Repair roads. Identify and repair, or remove, or relocate roads that are susceptible to mass wasting and bank failures, intercept surface or ground water, negatively impact riparian areas, and inhibit connectivity and natural stream functions; focusing on critical habitat areas.

1.3.4 Restore stream channels. Conduct stream channel restoration activities where they are likely to benefit native fish and only where similar results cannot be achieved by other, less costly and less intrusive means in critical habitat streams.

1.4 Operate dams to minimize negative effects on bull trout.

1.4.2 Provide safe passage downstream through dams and reservoirs. Provide safe downstream fish passage from Montana tributaries through dams and reservoirs for juvenile and adult bull trout.

1.5 Identify upland conditions that negatively affect bull trout habitats and implement tasks to restore appropriate functions.

1.5.1 Monitor fire effects and mitigate effects where necessary. Monitor effects from wild fires and pursue habitat restoration actions where warranted.

2 Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.

2.1 Develop, implement, and evaluate enforcement of policies on public and private fish stocking to reduce stocking of nonnative fishes that affect bull trout.

2.1.3 Encourage development of commercial sources of westslope cutthroat trout.

2.2 Evaluate policies for preventing illegal transport and introduction of nonnative fishes.

2.3 Inform the public about ecosystem concerns of illegal introductions of nonnative fish.

2.3.2 Develop bull trout education program. Develop a public information program with a broad emphasis on bull trout ecology and life history requirements and a more specific focus on regionally or locally important recovery issues.

2.4 Evaluate biological, economic, and social effects of control of nonnative fishes.

2.5 Implement control of nonnative fishes where found to be feasible and appropriate.

2.5.1 Experimentally remove established brook trout populations.

2.5.2 Suppress lake trout populations in bull trout core area FMO habitat.

2.5.3 Suppress brown trout where negative interaction with bull trout occurs.

2.6 Develop tasks to reduce negative effects of nonnative taxa on bull trout.

3 Establish fisheries management goals and objectives compatible with bull trout recovery and implement practices to achieve goals.

3.1 Develop and implement State and Tribal native fish management plans integrating adaptive research.

3.2 Evaluate and prevent overharvest and incidental angling mortality of bull trout.

3.3 Evaluate potential effects of introduced fishes and associated sport fisheries on bull trout recovery and implement tasks to minimize negative effects on bull trout.

3.3.1 Evaluate site-specific conflicts with introduced sport fish.

3.3.2 Regulate mainstem reservoirs to inhibit reproduction of nonnative fish. Evaluate options to regulate water levels on Thompson Falls, Noxon Rapids, and Cabinet Gorge Reservoirs, Lake Pend Oreille, and other regulated water bodies in a pattern to reduce survival of nonnative species that are detrimental to bull trout recovery.

3.4 Evaluate effects of existing and proposed sport fishing regulations on bull trout.

4 Characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout.

4.1 Incorporate conservation of genetic and phenotypic attributes of bull trout into recovery and management plans.

4.1.1 Conduct genetic inventory. Continue coordinated genetic inventory throughout recovery subunit and analysis of origin of bull trout captured downstream of Cabinet Gorge Dam.

4.2 Maintain existing opportunities for gene flow among bull trout populations.

4.3 Develop genetic management plans and guidelines for appropriate use of transplantation and artificial propagation.

5 Conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks.

6 Use all available conservation programs and regulations to protect and conserve bull trout and bull trout habitats.

7 Assess the implementation of bull trout recovery by recovery units and revise recovery unit plans based on evaluations.

In addition to these ongoing activities, with specifics generally too numerous to highlight individually here, there were a suite of recovery tasks, listed in the 2002 Draft Recovery Plan, that were considered to be fully accomplished. These tasks are listed, as they originally appeared in the 2002 plan, in Appendix II. Many are highlighted in the literature cited for this RUIP and in the documents from which recovery tasks were gleaned (Tasks are outlined in Table D-5).

Research, Monitoring, and Evaluation

There are multiple limiting factors for bull trout core area status in the CHRU that, while not fully meeting the definition of primary threat (*i.e.*, "core area specific", "likely to negatively impact populations", "manageable by specific actions", and "foreseeable"), they still may present near and long-term scientific or management challenges. Some of these limiting factors could rise to the level of primary threat in the foreseeable future if they increase in magnitude or intensity, or are better documented or understood. For that reason, we highlight these as important research needs and, in some cases, assign recovery tasks to them that are prioritized as priority 2 or priority 3 tasks.

Habitat Research and Monitoring Needs

Instream habitat has been severely and permanently altered in several complex core areas, including the majority of mainstem corridor FMO habitat in the Upper Clark Fork River, Middle Clark Fork River, Kootenai River, and portions of other core areas (*e.g.*, Blackfoot River, Bitterroot River, and Flathead River). Many of these impacts were the result of the development of primary transportation (highway and railroad) and utility corridors in the early or mid-20th century. The development of these corridors has often affected the habitat through the permanent loss of pools and instream habitat, water quality threats (*e.g.*, potential oil or chemical spills), and removal of large woody debris or ability to recruit new large woody debris. While ongoing management to lessen the impacts of these corridors can, and in some cases has improved conditions, the impacts cannot be fully mitigated or eliminated. In many cases, a permanent reduction in the carrying capacity of these systems for bull trout and other native salmonids has occurred as a result of transportation and utility corridors located in riparian zones. Additional research on the ongoing effects of these types of development in riparian areas, and additional tools to mitigate those effects could provide important tools to manage this ongoing threat.

There are two ongoing water quality threats that would also benefit from additional research. Ongoing efforts at Cabinet Gorge and Albeni Falls Dams to mitigate and reduce seasonally-elevated levels of total dissolved gases are progressing through modifications to the dam and spill gates (Weitkamp *et al*. 2003, Avista 2015). Similar concerns occur sporadically at Libby Dam (high water years involving large spills) (Dunnigan 2002, Marotz *et al*. 2007). To date, the elevated levels of total dissolved gases at these dams has not been demonstrated to affect bull trout at the population level, although individual fish have been documented to suffer trauma.

A second unresolved water quality issue involves increasing levels of selenium contamination in Lake Koocanusa and the Kootenai River, emanating from coal mining in the Elk River drainage in British Columbia, Canada (Kennedy *et al*. 2000). Elevated selenium concentration has been detected in some bull trout in Lake Koocanusa. Because the source of the potential contamination is outside the range of the listed entity and in a foreign country, and is subject to international processes involving the U.S Department of State, this recovery unit implementation plan has limited ability to impact the process. Monitoring of the selenium levels in the Kootenai River system and research on the impact of selenium on bull trout, particularly in respect to potential reproductive effects, would provide valuable warning of increased urgency in mitigating this threat.

Demographic Research and Monitoring Needs

Simple core areas, which are totally dependent on a single local population for persistence, are at greater demographic risk. Simple core area populations are typically small, isolated and subject to demographic risk from stochastic events or other factors. However, there are also cases where complex core areas are subject to the same risks due to fragmentation or other impacts that break formerly connected systems into isolated patches of discontinuous habitat (*e.g.*, Coeur d'Alene Lake and Upper Clark Fork River). Research into factors that affect bull trout population resiliency, replication and redundancy in core areas would help identify these risks.

Small Population Size

The science of population size as it relates to bull trout has been reviewed by multiple authors (*e.g.*, Rieman and Allendorf 2001, Whitesel *et al*. 2004). In general, larger populations are better at ensuring persistence and maintaining genetic diversity, but there are well-documented circumstances in the CHRU where bull trout populations have persisted for thousands of years at population levels or effective population sizes below theoretical minimums. During scoping for this implementation plan, we identified a handful of circumstances where monitoring of the population is considered adequate and redd counts are consistently in the low single digits. In those circumstances, the small population size was considered a primary threat (*e.g.*, some local pops in the Blackfoot River, LPO-C, and several simple core areas). However, we are also aware of core areas (or local populations) that appear to persist at very low levels, but where we lack accurate monitoring. And in a few simple core areas (*e.g.*, Lincoln Lake and Frozen Lake) demographic status is totally unknown or highly variable, making it difficult to determine trends and judge whether small population size is limiting. It is not surprising that such circumstances are often complicated by the presence of resident populations (sometimes derivative of formerly migratory life history forms). In the situations described above, it's imperative that we develop better monitoring strategies to more adequately characterize the demographic status and trends.

Fisheries Management

Actions that remove individual bull trout from a population can have population level impacts, especially where populations are small. This effect is exacerbated when large, highly fecund individuals are taken. Angling bycatch (catching of bull trout incidental to another fishery) typically results in some mortality even under ideal circumstances, though the individuals are returned to the stream. The mortality levels increase where streams are warm (*i.e*., summer), fish are already stressed (*i.e*., spawning migrations), where fishing methods result in deep hooking, or as a result of improper handling before release (Taylor and White 1992, Boyd *et al*. 2010, Andrusak and Thorley 2013). One post hoc survey of anglers in Montana highlighted the relationship between low numbers of bull trout, high numbers of anglers, and unique vulnerability of bull trout to angling (Fredenberg 2015). It is clear that anglers can impact demographic status of bull trout local populations and even core areas. Additional research is needed on the impact of angler bycatch, particularly in fluvial core areas (*e.g.*, Upper and Middle Clark Fork River, Rock Creek, Blackfoot River, and Bitterroot River) with the intersection of high angler use and low numbers of adult bull trout that are vulnerable up to 12 months of the year.

Fishery research and management itself may contribute to the loss of individuals from bull trout populations in some cases, whether it be from sampling by electrofishing or trapping (Al-Chokhachy *et al*. 2015); handling mortality as a result of implantation of radio transmitters, sonic tags, or PIT tags; or inadvertent mortality in gillnetting or trap bycatch while actively engaged in suppression of lake trout or other species. In the latter case, up to several hundred adult and subadult bull trout can be eliminated annually from a single core area (IDFG 2014, Rosenthal and Fredenberg 2014). While these efforts are important for the conservation of bull trout, continued monitoring and research into methods to reduce the loss would allow us to identify if, where, and when this threat may have an effect on bull trout recovery.

Connectivity Impairment

Some mainstem dams have functionally reduced core area connectivity through loss of upstream passage, and often created shallower and warmer reservoirs that become a poor surrogate for formerly free-flowing rivers. The impaired connectivity of formerly interacting populations can lead to effective reduction of the size and scope of the functioning core area. This represents a primary threat, for example, to those local populations of bull trout occupying the portions of the Lake Pend Oreille core area that are not connected.

The threat from impaired connectivity in cases where large mainstem dams created and expanded higher quality FMO habitat upstream of the dams (*e.g.*, Libby Dam and Lake Koocanusa, Hungry Horse Dam and Reservoir, or Painted Rocks Dam and Reservoir and West Fork Bitterroot River) is less obvious. In these cases, the headwaters SR habitat remains productive and fish passage is not provided, bisecting the original core area into two smaller core areas. This can have both advantages and disadvantages. Bull trout in the upstream portion of such systems sometimes benefit by having surrogate FMO habitat more closely connected to SR habitat. In some cases, this surrogate FMO habitat contains an improved and expanded forage base that may even support bull trout numbers that far exceed pre-dam conditions (as in the case of Lake Koocanusa). The downside of bisecting core areas is often realized in the downstream portion of the previously-connected core area. In the case of the Kootenai River, Flathead Lake, or Bitterroot River core areas, some of the most productive and coldest headwater SR habitat is now disconnected from remaining downstream core area habitat. SR habitat that does remain may not be adequate in amount or condition to support bull trout populations at their former level. For example, Hungry Horse Dam blocked access to approximately 37 tributary streams and 38 percent of the potential SR habitat for native salmonids (bull trout and westslope cutthroat trout) from Flathead Lake (Zubik and Fraley 1987).

In the case of Hungry Horse Reservoir, the dam created *de facto* refugia for native fish by blocking the invasion of nonnative fish (competitors or predators) from downstream. However, this also reduced the productivity of the Flathead Lake bull trout population that was previously connected to the SR habitat in the South Fork Flathead River.

In some circumstances, most notably the example of Lake Koocanusa, the regulated nature of the Kootenai River downstream of the dam may negatively alter FMO habitat by failure to recruit new LWD and development of gravel deltas that make access to some tributary streams difficult at lower flows. In other circumstances (*e.g.*, Bitterroot River), the ability to store cold water for summer discharge, and therefore keep water temperatures in portions of the river at lower levels may provide a net benefit.

Continued monitoring of populations isolated by the loss of connectivity would help ensure populations in these now smaller core areas are not lost due to fragmentation. Depending on the individual situation, as described above, research on methods to mitigate the effects of core area bisection may yield management opportunities.

Nonnative Fish Research and Monitoring Needs

Brown Trout

One of the most compelling current research and monitoring needs in the CHRU is the evidence of increasing distribution and abundance of brown trout throughout many of the fluvial habitats occupied by bull trout. Brown trout represent a potential threat to bull trout through competition for habitat and resources, as well as predation on young bull trout. In at least 8 of the 15 complex core areas (including the entire Clark Fork headwaters and mainstem, as well as the Kootenai River) brown trout appear to be responding to increasingly warmer water temperatures as a result of changing climate and streamflow patterns and are beginning to encroach upstream into lower portions of many accessible spawning and rearing tributaries (Al-Chokhachy *et al*. 2015). Because brown trout are a popular sport fish often supported by management efforts to increase their abundance (Saffel *et al*. 2011), we are concerned about the long-term trajectory. Brown trout occupy a very similar niche to bull trout (fall-spawning, large-bodied, piscivorous, cover-seeking salmonid). Whether brown trout are responding to environmental cues and occupying habitat no longer suitable for bull trout, or brown trout are actively displacing bull trout is an area for active research and evaluation (Al-Chokhachy *et al*. 2015). Experimental manipulation of certain populations (*e.g.*, suppressing brown trout to measure bull trout response), as is being done in the Avista funded East Fork Bull River Nonnative Fish Suppression Project, may be warranted in other waters. Portions of the Rock Creek core area could provide potential sites for further research in this issue, as the invasion is particularly active in this watershed.

Lake Trout

There are several active and ongoing studies of lake trout suppression. Lake trout represent a primary threat to bull trout in some core areas. Research on better and more cost-effective methods of lake trout suppression is a critical need in systems where they currently occur, and for areas they may invade in the future. Active suppression projects to benefit bull trout, primarily using gillnets, are occurring in Lake Pend Oreille (Hansen *et al*. 2010, Wahl *et al*. 2013), Quartz Lake in Glacier National Park (Fredenberg 2015), Swan Lake (Rosenthal and Fredenberg 2014; Rosenthal *et al*. 2015) and Upper Priest Lake (Ryan *et al*. 2014). Lake trout suppression has also been explored as a management tool in Flathead Lake (CSKT 2014). In the last few years, the collective results of these research efforts have increasingly supported the conclusion that gill netting, if implemented at sufficiently high levels of effort, can successfully reduce lake trout and result in benefits to some of the more rapidly responding target species (*e.g.*, Yellowstone cutthroat trout and kokanee), though at a cost. Ongoing research into ways to suppress lake trout reproduction (*e.g*., suppression of ova through lethal electrofishing, suctioning of eggs or embryos, or genetic methods) is an important but largely unfunded area of research need. Efforts continue to measure the response by top-level predators such as bull trout to these suppression efforts, and to assess cost-effective methods to minimize bycatch of bull trout and other non-target species.

Brook Trout

While brook trout have interacted with bull trout since the 1930s or 1940s in most of the core areas in the CHRU, the effects vary depending on circumstances. In many core areas that are strongly or exclusively adfluvial (*e.g.*, Swan Lake and direct tributaries to Lake Pend Oreille), brook trout are common to abundant in much of the SR habitat. In such circumstances, hybrids are often also common, especially in the lower SR reaches and FMO habitat, and some hybrid individuals are quite large (notably up to 5 pounds (lbs) (2.3 kilograms) or more in Swan Lake). In one study, the biomass of brook trout and hybrids exceeded the biomass of juvenile bull trout in some important SR tributaries (Fredenberg *et al*. 2007). Despite brook trout and hybrids being common in these circumstances, we have little evidence that hybridization is progressive or that brook trout hybridization will eventually lead to bull trout extirpation. It is hypothesized that in core areas where high quality FMO habitat (deep, cold lakes) is attached to an abundance of high quality SR habitat (*e.g.*, Swan Lake) there is enough behavioral isolation or size differential between spawning adfluvial bull trout and brook trout to maintain adequate recruitment of bull trout, despite proliferation of brook trout.

In some other core areas of the CHRU fluvially-oriented bull trout populations naturally predominate (*e.g.*, Upper Clark Fork River, Bitterroot River, Rock Creek, Blackfoot River, and Kootenai River), or fluvial life history occurs when connectivity to lacustrine habitat has been reduced from historical conditions by dams (*e.g.*, Middle Clark Fork River, Lake Pend Oreille A, and C). In those circumstances adult bull trout tend to be smaller (*e.g.* often 2 to 5 lbs [0.9 to 2.3 kilograms]). Where bull trout are smaller, the behavioral or physiological disincentives to brook trout/bull trout hybridization may be reduced, fecundity of migratory fish is lower, and hybridization may be increasingly common (DeHaan *et al*. 2009). The degree to which the effect is due to reduced habitat suitability for bull trout relative to brook trout versus how much may be due to reduced fitness or other demographic factors is uncertain (DeHaan *et al*. 2009). This is an area ripe for further academic research.

It is suspected that the greatest threat brook trout present to bull trout persistence occurs in resident populations. Since the CHRU was historically well connected, current resident populations are believed to be largely a result of isolation and fragmentation of formerly migratory stocks. The Bitterroot River core area exemplifies this. Where resident bull trout and brook trout co-occur, the sizes of adults are often similar. Where neither species is migratory and size differential does not act as a reproductive isolating factor, the threat of progressive hybridization seems to be accentuated (DeHaan *et al*. 2009). This is but one of many reasons that loss of migratory life history forms is damaging to the long term persistence of bull trout. Additional research to document the effect of hybridization on resident bull trout is needed. Monitoring of resident populations to identify new brook trout invasions is also needed.

Warmwater or Coolwater Species

The presence of nonnative northern pike, smallmouth bass, walleye, and other warmwater species is a primary threat in a few core areas, but has the potential to expand to other core areas. Since the early part of the 20th century, nonnative warm and cool water fish have been introduced to the CHRU, often by management agencies seeking to “improve” or “diversify” fisheries. With better planning, greater scientific awareness and more thorough environmental review, the number of legal nonnative fish introductions has generally been reduced in recent decades. Conversely, with the greater mobility of anglers and the more recent availability of livewells in sportfishing boats, the number of illegal and unauthorized introductions has skyrocketed over the same period. MFWP has documented hundreds of such occurrences (MFWP 2015) and has waged both legal and outreach campaigns to increase awareness. The problems are most severe in western Montana, overlapping with the range of bull trout. The illegal introductions of nonnative fish seem to be most successful in lake environments, where the FMO habitat of bull trout often occurs. While largemouth bass and yellow perch have occupied many of these lakes for decades, there is considerably more uncertainty about the impact on bull trout from more recent successful illegal introduction of species such as northern pike, smallmouth bass, walleye, and black crappie. Monitoring of these introductions and research on tools to reduce or eliminate these species when they are introduced are critical to preventing this from becoming a primary threat in more core areas. Of course, introductions in the headwaters also have implications downstream.

Recovery Measures Narrative

A list of individual recovery actions, specific to core areas, as identified within the CHRU follows. It is organized by core area in roughly downstream order. In the Flathead geographic region, 11 simple core areas in Glacier National Park, 7 simple core areas in the Flathead Valley, and 3 core areas in the Swan Valley (1 complex, 2 simple) are bundled into combined narratives due to similarity and in order to limit redundancy.

For each recovery action a title is underlined and carried forward (sometimes in abbreviated format) to the implementation schedule (Table D-5), where details of priority, partners, and costs are provided. Each recovery action is accompanied below by a brief narrative with appropriate details of methods, rationale, scope, and implementation considerations.

The recovery measures narrative for each core area within the Columbia Headwaters Recovery Unit is structured in a hierarchical step-down narrative under which specific recovery actions are grouped and listed to address identified primary threats. We established three broad primary threat category classifications (Habitat, Demographic, and Non-Natives) which were further subdivided into more specific second tier threat categories where applicable:

- Habitat – Upland/Riparian Land Management, Instream Impacts, and Water Quality
- Demographic – Connectivity Impairment, Fisheries Management, Small Population Size, and Forage Fish Availability
- Nonnatives – Nonnatives

Specific recovery actions are each listed under a third tier of individual threat descriptors which were developed to more specifically characterize these second tier threat categories for that particular core area. If a second-tier threat category is not applicable to a particular core area, no third-tier threats are listed in the narrative and the second tier threat is gray-shaded. Core areas and their specific recovery actions have been grouped by the five major geographic regions shown in Table D-2 above. In addition to third-tier recovery actions that address identified primary threats, we also identified and listed additional conservation recommendations within the recovery measures narrative. These actions are considered beneficial for bull trout conservation and merit implementation, but do not address primary threats and are not considered necessary to meet recovery objectives within a core area.

We believe that the most effective way to implement bull trout recovery in the CHRU is to combine a bottom-up approach that supports existing recovery efforts that partners have already agreed to and are implementing, along with necessary prescriptive actions that sometimes may be delayed or unlikely to occur at all. The majority of recovery actions in this RUIP were taken directly from other land, water, and natural resource planning documents, most of which were developed through collaborative processes involving interagency forums and many involving public participation. Many of these actions are opportunity based and occur in conjunction with mitigation programs or other activities. These plans have nearly all been developed since the time of bull trout listing in 1998, and many have already contributed measurably to focusing mitigation programs and agency activities on priorities for bull trout recovery (see *e.g.*, Appendix II). Some bull trout populations have responded positively to these actions, but others have not (USFWS 2008a, 2008b).

In many cases, recovery action wording is taken directly from original source document(s), or closely paraphrased, with some editing for purposes of updating, brevity, and clarity. Recovery actions that are not sourced were generally new additions to this RUIP to cover gaps identified during our scoping process (*i.e.*, threats with no identifiable actions found in existing source literature). Recovery tasks that address primary threats are bolded.

Primary sources for most of the referenced recovery tasks include (but not limited to) the following:

Avista	1998	Clark Fork River Native Salmonid Restoration Plan (NSRP)
Avista	1999	Clark Fork Settlement Agreement (CFSA)
Avista	2012	Native Salmonid Program 5-year Plan 2011-2015
BPA	2004	Pend Oreille Subbasin Plan
BPA	2004	Kootenai Subbasin Plan
BPA	2004	Coeur d'Alene Subbasin Plan
BPA	2009	Blackfoot River Subbasin Plan
BPA	2009	Bitterroot River Subbasin Plan
CSKT	2009	Jocko River Wetland/Riparian Habitat and Bull Trout Restoration Plan
CSKT	2013	Kerr Project Annual Report and Workplan
CSKT	2014	Flathead Lake EIS
IDFG	2013	Statewide Fisheries Management Plan
MDNRC	2010	State Forest Land Management Plan Monitoring Report
MFWP	2000	Montana Bull Trout Restoration Plan
MFWP and CSKT	2002	Flathead Native Trout Security Levels
MFWP	2008	Blackfoot River Restoration Plan
MFWP	2011	Upper Clark Fork Restoration Prioritization
MFWP	2013	Statewide Fisheries Management Plan
NOAA Fisheries	2008	Consultation for Operation of the Federal Columbia River Power System
Plum Creek Timber Co.	2013	Plum Creek Native Fish HCP Annual Report
PPL Montana	2013	Thompson River Bull Trout Plan
Seattle City Light	2010	Boundary Hydroelectric Project Fish and Aquatics Management Plan
Seattle City Light	2010	Mill Pond Dam Removal and Restoration Alternatives
USFS	2013	Bull Trout Conservation Strategy
USFWS	2002	Draft Bull Trout Recovery Plan
USFWS	2007	Glacier National Park Bull Trout Action Plan
USFWS	2008	Thompson Falls Hydroelectric Project Consultation
WSCC	2003	Bull Trout Habitat Limiting Factors for WRIA 62

Upper Clark Fork Geographic Region

Upper Clark Fork River Core Area (Complex)

Recovery tasks that address primary threats are bolded.

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

1.1.1 **Prioritize Warm Springs Creek and Upper Clark Fork River for restoration.** Upper Warm Springs Creek (including tributaries Storm Lake Creek, Twin Lakes Creek, West Fork Warm Springs Creek, and Barker Creek; as well as the upper mainstem Clark Fork River (Warm Springs Cr. confluence downstream to Deer Lodge) are rated as priority 1 streams (highest) for habitat enhancement to restore fisheries under the ARCO Natural Resource Damage Settlement.

1.1.2 **Prioritize Flint Creek, Boulder Creek, and Harvey creeks for restoration.** Flint Creek and its tributary Boulder Creek, Harvey Creek, and the mainstem Clark Fork River from Deer Lodge downstream to Bonner is rated as a priority 2 (second highest) stream for habitat enhancement to restore fisheries under the ARCO Natural Resource Damage Settlement (Saffel *et al*. 2011).

1.2. Instream Impacts

1.2.1 Reduce operational impacts. Review operational concerns (*e.g.*, water level manipulation and interbasin transfers) of complex water systems in upper Warm Springs and Flint Creek watersheds and provide recommendations, if necessary, to benefit bull trout (see also 2.1.1).

1.2.2 Provide instream flow downstream of Georgetown Lake. Maintain or exceed established instream flows downstream of Georgetown Lake (Flint Creek).

1.3. Water Quality

1.3.1 **Supply cold water**. The primary prescription to address climate change in the upper Clark Fork River is to continue to strengthen connectivity and consolidate habitat gains in headwater SR tributaries while seeking to direct more sources of cold water into the mainstem Clark Fork River FMO habitat, through acquisition, irrigation efficiency, or development of new sources.

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

2.1.1 **<u>Remove barriers on Warm Springs, Twin Lakes, and Flint Creeks</u>.** **Examine** multiple barriers (diversions and culverts) on bull trout watersheds in the Upper Clark Fork River and provide passage at select diversions.

2.2. Fisheries Management

2.3. Small Population Size

2.3.1 <u>Enhance Silver Lake adfluvial stock</u>. Enhance adfluvial bull trout population for conservation in Silver Lake.

2.3.2 <u>Enhance migratory populations for conservation</u>.

3. Actions to Address Nonnatives

3.1 Nonnative Fish

3.1.1 **<u>Aggressively protect remaining native species complexes</u>.** Protect integrity of intact native species assemblages, such as Harvey, Warm Springs, and Boulder Creeks, by aggressively removing nonnative invaders (*i.e.*, brook trout or brown trout).

3.1.2 **<u>Isolate Harvey Creek from nonnative fish</u>.** Maintain barrier or provide selective passage on Harvey Creek to protect native fish populations from invasion by brown trout and rainbow trout.

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.2 Demographics

4.3 Nonnatives

Conservation Recommendations

2.2.1 <u>Maintain angling closure for bull trout</u>. Continue yearlong closure on angling for bull trout.

2.2.2 <u>Prioritize resident bull trout for conservation</u>. Enhance resident and migratory populations for conservation in Warm Springs Creek

2.3.3 Incorporate survey data into Upper Clark Fork core area threats assessment. Evaluate whether a self-reproducing migratory population is established or maintained in the Upper Clark Fork River core area (connected to and spawning in all suitable tributary streams, and sufficiently robust to maintain demographic and genetic viability).

4.2.1 Improve knowledge of distribution. The Flint Creek drainage, along with Storm Lake Creek and Harvey Creek are high priorities for additional presence/absence survey mapping, using new e-DNA survey techniques. This will better enable restoration projects to target improved connectivity amongst cold water patches and work toward situationally restoring the migratory life history form.

Rock Creek Core Area (Complex)

Recovery tasks that address primary threats are bolded.

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

1.1.1 Upgrade or relocate problem roads. Increase maintenance of extensive secondary road systems—U.S. Forest Service and State lands—by increased application of best management practices, with emphasis on remediating sediment-producing hotspots and on maintaining bridges, culverts, and crossings in drainages that support bull trout spawning and rearing. Decommission surplus forest roads, especially those that are chronic sources of sediment and those that are located in areas of highly erodible geological formations. Remove culverts and bridges on closed roads that are no longer maintained. Priority watersheds include all designated bull trout CH; especially SR habitat.

1.2. Instream Impacts

1.2.1 Reduce East Fork Reservoir operational impacts. Review reservoir operational concerns (*e.g.*, water level manipulation, minimum pool elevation) and provide operating recommendations for East Fork Reservoir (East Fork Rock Creek).

1.2.2 Provide instream flow downstream of dams. Maintain or exceed established instream flows downstream of East Fork Reservoir (East Fork Rock Creek).

1.3. Water Quality

1.3.1 **Supply cold water**. The primary prescription to address climate change in Rock Creek is to continue to strengthen connectivity and consolidate habitat gains in headwater SR tributaries while seeking to direct more sources of cold water into the mainstem FMO habitat, through acquisition, irrigation efficiency, or development of new sources.

2. Actions to Address Demographic Threats

2.1 Connectivity Impairment

2.2. Fisheries Management

2.2.1 Enhance East Fork Reservoir adfluvial stock. Enhance adfluvial populations for conservation in East Fork Reservoir.

2.3. Small Population Size

3. Actions to Address Nonnatives

None

4. Research, Monitoring, and Evaluation

None

Conservation Recommendations

1.1.2 Prioritize Rock Creek and tributaries for restoration. The mainstem of Rock Creek and its tributaries Ranch Creek, Stony Creek, West Fork, Ross Fork, and Middle Fork Rock Creek are rated priority 3 streams (1 to 4 scale) for habitat enhancement to restore fisheries under the ARCO Natural Resource Damage Settlement. Other CH tributaries are either rated priority 4 (Butte Cabin Cr., Hogback Cr., Carpp Cr., East Fork) or were assessed and determined to not be a priority (Saffel *et al*. 2011)

2.3.1 Incorporate survey data into Rock Creek core area threats assessment. Evaluate whether a self-reproducing migratory population is established or maintained in the Rock Creek core area (connected to and spawning in all suitable tributary streams, and sufficiently robust to maintain demographic and genetic viability).

Blackfoot River Core Area (Complex)

Recovery tasks that address primary threats are bolded.

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

1.1.1 **Prioritize Blackfoot River tributaries for restoration.** All bull trout local populations and migratory corridors (*i.e*., streams subsequently designated by the Service as Critical Habitat) are in the highest tier of priorities for stream restoration actions (of 182 streams and stream segments identified) under the Blackfoot Challenge (Pierce *et al*. 2008).

1.1.2 **Improve habitat through best management practices (BMPs) and conservation easements.** Improve wetlands and riparian/upland habitat through BMPs and conservation easements along Blackfoot River mainstem, Cottonwood Creek, Poorman Creek, Dunham Creek, Landers Fork, North Fork Blackfoot River, and Monture Creek.

1.1.3 **Address roads and mitigate associated sediment concerns.** Priorities are Belmont Creek, Copper Creek, Cottonwood Creek and Poorman Creek watersheds.

1.1.4 **Reduce road impacts in Cottonwood and Monture Creeks.** Reduce road densities; remove culverts to reduce sediment in Cottonwood Creek and Monture Creek.

1.1.5 **Assess roads in North Fork Blackfoot.** Conduct roads assessment and address problems identified in the North Fork Blackfoot River drainage.

1.1.6 **Mitigate residential development impacts on Monture Creek.** Mitigate residential development impacts and associated sediment concerns in Monture Creek.

1.2. Instream Impacts

1.2.1 Mitigate sediment sources basinwide. Address sediment input from land management practices throughout the Blackfoot River drainage.

1.2.2 Address recreational use impacts. Mitigate sediment concerns in mainstem Blackfoot River, Copper Creek, Landers Fork, Monture Creek and North Fork Blackfoot River caused by heavy recreational use.

1.2.3 Improve instream flows. Improve instream flows in upper Blackfoot River and mainstem Blackfoot River between the Clearwater River confluence and the Clark Fork River junction.

1.2.4 Improve passage and entrainment issues. Improve fish passage and irrigation systems to reduce entrainment and dewatering in Belmont, Copper, Cottonwood, Dunham, Gold, Poorman and Monture creeks, and Landers Fork and North Fork Blackfoot River.

1.2.5 Restore instream habitat. Restore instream channel form and function, thereby improving fish habitat in Dunham Creek, Gold Creek, Landers Fork, Monture Creek, and North Fork Blackfoot River.

1.2.6 Improve spawning and rearing habitat. Improve degraded spawning and rearing habitat (instream) in Poorman Creek.

1.3. Water Quality

1.3.1 Restore Gold Creek watershed. Acquire lands or easements to protect and restore the watershed.

1.3.2 Protect water quality. Remove streamside feedlots in the reach of the mainstem Blackfoot River between Nevada and Arrastra creeks.

1.3.3 Improve water quality. Continue to implement water quality improvement projects to reduce water temperatures, sediment, and other pollutants.

1.3.4 Supply cold water. The mainstem Blackfoot River FMO habitat is exceptionally warm in the lower reaches during summer and could benefit greatly from additional cold water infusion low in the watershed. While the Blackfoot Challenge partnership continues to strengthen connectivity and consolidate habitat gains in headwater SR tributaries, similar actions are needed to direct more sources of cold water into the lower mainstem FMO habitat, through acquisition, irrigation efficiency, or development of new sources.

2. Actions to Address Demographic Threats

2.1 Connectivity Impairment

2.2 Fisheries Management

2.3. Small Population Size

2.3.1 Enhance migratory populations for conservation.

2.3.2 Incorporate survey data into Blackfoot River core area threats assessment. Evaluate whether a self-reproducing migratory population is established or maintained in the Blackfoot River core area (connected to and spawning in all suitable tributary streams, and sufficiently robust to maintain demographic and genetic viability).

3. Actions to Address Nonnatives

3.1 Nonnative Fish

3.1.1 Suppress nonnative fish. Continue to work to reduce the threat of nonnative fish interactions.

3.1.2 Aggressively protect remaining native species complexes. Protect integrity of all intact native species assemblages, such as Belmont and Copper Creeks and the Landers Fork of the Blackfoot River, by aggressively removing nonnative invaders (*i.e.*, brown trout and brook trout).

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.2 Demographic

4.3 Nonnatives

Conservation Recommendations

4.1.1 Consider passage around natural barriers. Evaluate and make recommendations concerning potential benefits of fish passage around, or establishment of resident bull trout populations upstream of, natural barriers as a way to conserve genetic diversity in existing bull trout populations in: Arrastra Creek (section 24), Landers Fork (Silver King Falls), and North Fork Blackfoot River above North Fork Falls.

Clearwater River & Lakes Core Area (Complex)

Recovery tasks that address primary threats are bolded.

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

1.1.1 **<u>Decommission roads in East Fork Clearwater</u>.** Decommission portions of FSR 646 to reduce sediment input in the East Fork Clearwater River.

1.1.2 **<u>Restore habitat in West Fork Clearwater</u>.** Investigate a possible TNC/ MFWP collaboration to restore habitat in the West Fork Clearwater River.

1.1.3 **<u>Reduce road density in Placid Creek watershed</u>.** Reduce road density to reduce sediment in the Placid Creek watershed. Repair past logging effects, consolidate roads.

1.1.4 **<u>Improve habitat through BMPs and conservation easements</u>.** Improve riparian/upland habitat and associated sediment concerns through BMPs along Boles Creek, East Fork and West Fork Clearwater River, Marshall Creek, Morrell Creek, and Placid Creek

1.1.5 **<u>Acquire conservation easements</u>.** Acquire restoration/conservation easements in important bull trout watersheds (*e.g.*, critical habitat).

1.2. Instream Impacts

1.2.1 <u>Enhance instream flow in West Fork Clearwater</u>.

1.3. Water Quality

1.3.2 <u>Supply cold water.</u> The primary prescription to address climate change in the Clearwater River and Lakes core area is to continue to strengthen connectivity and consolidate habitat gains in headwater SR tributaries while seeking to direct more sources of cold water into the mainstem Clearwater River FMO, through acquisition, irrigation efficiency, or development of new sources.

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

2.1.1 <u>Improve passage and entrainment issues in Morrell Creek.</u> Continue to monitor and improve fish passage and irrigation systems to minimize entrainment and dewatering in Morrell Creek.

2.2. Fisheries Management

2.3. Small Population Size

3. Actions to Address Nonnatives

3.1 Nonnative Fish

3.1.1 **Suppress northern pike in Clearwater Lake chain.** Continue assessment of pike interactions in Clearwater Chain of Lakes, with emphasis on continued suppression of those populations.

3.1.2 **Suppress competing or predating nonnatives in lakes to conserve adfluvial bull trout.** Where nonnative species impacts in FMO habitat (primarily lakes) are identified, suppress bass, brown trout, or other competing and predating species as needed in order to enhance survival of the adfluvial life history form of bull trout.

3.1.3 **Minimize brook trout populations in SR tributaries.** Continue regular population assessments and, if warranted, evaluate opportunities for removing brook trout from selected SR streams. Priority watersheds include East and West Fork Clearwater River, Morrell Creek, and Marshall Creek.

4. Research, Monitoring, and Evaluation

None

Conservation Recommendations

1.3.1 Address recreation and residential impacts along Clearwater River and Morrell Creek. Protect habitat (instream and upland) and mitigate recreation use and residential development impacts and associated concerns along mainstem Clearwater River and Morrell Creek.

2.1.2 Continue to emphasize systemwide connectivity. Emphasize continued maintenance and improvement of existing patches of cold water SR habitat and enhancement of connectivity for adfluvial fish from the lakes to access those SR resources.

2.1.3 Conserve and enhance migratory populations.

2.3.1 Incorporate survey data into Clearwater River and Lakes core area threats assessment. Evaluate whether a self-reproducing migratory population is established or maintained in the Clearwater River and Lakes core area (connected to and spawning in all suitable tributary streams, and sufficiently robust to maintain demographic and genetic viability).

West Fork Bitterroot River Core Area (Complex)

Recovery tasks that address primary threats are bolded.

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

1.2. Instream Impacts

1.2.1 Reduce Painted Rocks Reservoir operational impacts. Continue to review reservoir operational concerns (*e.g.*, water level manipulation, minimum pool elevation) and provide annual operating recommendations for Painted Rocks Reservoir to protect bull trout.

1.3. Water Quality

2. Actions to Address Demographic Threats

None

3. Actions to Address Nonnatives

3.1 Nonnative Fish

3.1.1 Minimize nonnative fish impacts. Maintain and enhance existing connectivity of SR streams to Painted Rocks Reservoir while remaining vigilant against any nonnative fish introductions.

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.2 Demographic

4.3 Nonnatives

Conservation Recommendations

2.3.1 Incorporate survey data into West Fork Bitterroot River core area threats assessment. Evaluate whether a self-reproducing migratory population is established or maintained in the West Fork Bitterroot River core area (connected to and spawning in all suitable tributary streams, and sufficiently robust to maintain demographic and genetic viability).

4.2.1 Improve knowledge of distribution. Painted Rocks tributaries are high priorities for additional presence/absence survey mapping, using new e-

DNA survey techniques. This will better enable restoration projects to target improved connectivity amongst cold water patches and facilitate work toward restoring better connectivity for remnants of the migratory life history form.

Bitterroot River Core Area (Complex)

Recovery tasks that address primary threats are bolded.

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

1.1.1 **Improve Lolo Creek riparian habitat.** Work with private ranchers, through nongovernmental organizations to initiate changes in riparian management to favor healthier riparian zones in Lolo Creek watershed.

1.2. Instream Impacts

1.2.1 **Assess and decommission roads in Lolo Creek watershed.** Road assessment and removal is a high priority of the USFS MT Legacy Project for the Lolo Creek watershed.

1.2.2 **Add LWD in Lolo Creek watershed.** Add large woody debris complexes to the East Fork and Lost Park Creek in Lolo Creek watershed to create large, complex pool habitat.

1.2.3 **Provide instream flow downstream of dams.** Maintain or exceed established instream flows downstream of Painted Rocks Reservoir (West Fork Bitterroot River) to supplement the mainstem.

1.2.4 **Provide instream flow downstream of dams.** Establish instream flows from high-elevation reservoirs in the Bitterroot National Forest on Bass, Big, Blodgett, Burnt Fork, Fred Burr, and Tin Cup Creeks.

1.3. Water Quality

1.3.1 **Restore shade to reduce water temperature in Nez Perce Fork.** Reduce water temperature by implementing the TMDL (restoring shade) along FSR 468 on Nez Perce Fork, Bitterroot River.

1.3.2 **Supply cold water.** The primary prescription to address climate change in the Bitterroot River is to continue to strengthen connectivity and consolidate habitat gains in headwater SR tributaries while seeking to direct more sources of cold water into the mainstem Bitterroot River FMO habitat, through acquisition, irrigation efficiency, or development of new sources.

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

2.1.1 **Improve Howard Creek and other Lolo Creek passage.** Work with MDOT to improve year-round fish passage at the Highway 12 crossing of Howard Creek. Determine whether barriers exist in other portions of the watershed on recently acquired roads and take actions to address them.

2.1.2 **Improve Warm Springs Creek passage.** Replace culvert with bridge on FSR370 on Warm Springs Creek.

2.1.3 **Improve Boulder Creek passage.** Remove the culvert on Boulder Creek, West Fork Hwy, Bitterroot River.

2.1.4 **Improve West Fork Bitterroot passage.** Remove two culverts at highway crossings (West Fork Hwy Culvert and FSR1130 culvert) on Little Boulder Creek in the West Fork Bitterroot River. Remove three to six other potential culvert barriers in the West Fork Bitterroot River.

2.2. Fisheries Management

2.3. Small Population Size

2.3.1 Conserve and enhance Bitterroot River migratory populations. Enhance migratory bull trout populations for conservation in the East Fork and mainstem Bitterroot.

3. Actions to Address Nonnatives

3.1 Nonnative Fish

3.1.1 **Minimize nonnative brook and brown trout in known SR refugia**. Because habitat in this core area is highly fragmented and the migratory life history form has been marginalized, there is higher potential for brook and brown trout to systematically outcompete bull trout and for brook trout to hybridize bull trout out of existence in many SR streams. A system of important refugial patches in streams aligning with persistent cold water habitat should be designated and safeguards put in place to at least maintain the status quo. Likely candidates may include portions of Lolo, Burnt Fork, Skalkaho, and Sleeping Child creeks.

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.1.1 Conduct barrier assessment. Inventory migration barriers and develop strategy for improvements.

4.2 Demographic

4.3 Nonnatives

Conservation Recommendations

2.3.2 Incorporate survey data into Bitterroot River core area threats assessment. Evaluate whether a self-reproducing migratory population is established or maintained in the Bitterroot River core area (connected to and spawning in all suitable tributary streams, and sufficiently robust to maintain demographic and genetic viability).

4.2.1 Quantify entrainment losses in diversions.

4.2.2 Improve knowledge of distribution. Bitterroot River tributaries are high priorities for additional presence/absence survey mapping, potentially using new e-DNA survey techniques. This will better enable restoration projects to target improved connectivity amongst cold water patches and facilitate work toward restoring better connectivity for remnants of the migratory life history form.

4.2.3 Consider passage around natural barriers. Evaluate and make recommendations concerning potential benefits of fish passage around, or translocation of resident bull trout populations upstream of natural barriers as a way to conserve genetic diversity in existing bull trout populations in: Bass, Daly, North Lost Horse, Overwhich, and Sweathouse Creeks upstream of falls.

4.3.1 Establish distribution of nonnative trout. Determine and continue to track tributary-specific upstream extent of nonnative species.

Middle Clark Fork River Core Area (Complex)

Recovery tasks that address primary threats are bolded.

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

1.1.1 **Improve Fish Creek riparian habitat.** Work with private landowners to improve riparian conditions on Fish Creek.

1.1.2 **Improve road and timber BMPs in Fish Creek.** Implement road removal; minimize timber harvest in lower valleys and riparian habitats in Fish Creek.

1.1.3 **Consolidate and minimize roads in South Fork Little Joe (St. Regis River).** Remove the South Fork road and all associated access roads in the South Fork Little Joe watershed (St. Regis River) conducive with long-term bull trout conservation. This can be accomplished by maintaining the tie through from the North Fork to Moore Lake (USFS 2013).

1.1.4 **Consolidate and minimize roads in Ward Creek (St. Regis River).** Remove the Ward Creek (#889) road and all associated access roads in the Ward Creek watershed (St. Regis River) conducive with long-term bull trout conservation. Maintaining the Twomile road (#431) would retain recreational access to lakes in the headwaters of Ward Creek (USFS 2013).

1.1.5 **Consolidate and minimize roads in Twelvemile Creek (St Regis River).** Address the negative influence in Twelvemile Creek of the Twelvemile/Thompson Falls road (#352) that parallels the mainstem for most of its length (and associated timber access roads) (USFS 2013).

1.1.6 **Consolidate and minimize roads in Big Creek (St Regis River).** Significantly reduce existing road densities by obliterating riparian roads along the Middle Fork, upper West Fork, Rivers Creek (or East Fork) and Gilt Edge Creek drainages. Remove corresponding logging road systems associated with these valley bottom roads (USFS 2013).

1.1.7 **Consolidate and minimize roads in Deer Creek (St. Regis River).** Opportunities to improve conditions for bull trout in Deer Creek (St. Regis River) revolve around transportation planning and reducing road densities. There are opportunities to remove the valley bottom and timber access roads, as recreation access to high mountain lakes would still be available from the Stateline Road (USFS 2013).

1.1.8 **Upgrade problem roads on Plum Creek Timber lands.** Continue upgrading of all remaining Plum Creek roads to meet the 2015 Native Fish Habitat Conservation Plan deadline.

1.2. Instream Impacts

1.2.1 **Rehab Trout Creek mining claims.** Implement restoration projects related to inactive mining claims on Trout Creek.

1.2.2 **Rehab Cedar Creek mining claims.** Implement road density reduction and restoration projects related to inactive mining claims in Cedar Creek.

1.2.3 **Increase LWD in Fish Creek and Trout Creek watersheds.** Increase the scope and magnitude of large woody debris addition projects to significantly improve temperature and pool habitat and complexity throughout the Fish Creek and Trout Creek watersheds.

1.2.4 **Improve FMO habitat**. Abundance of fluvial migratory fish in the Middle Clark Fork is compromised by poor FMO habitat and warm summer temperatures in the Clark Fork River. This limits potential productivity gains that might be realized by restoring connectivity for spawning adfluvial fish from Lake Pend Oreille. The challenge of restoring cold water to a system this large is daunting, but we should begin by striving to maximize habitat quality and security in those microhabitats of the mainstem Clark Fork River FMO habitat found at the junctions of cold water tributaries that act as important refugia for migratory adult fish.

1.3. Water Quality

1.3.1 **<u>Continue stream temperature monitoring on Plum Creek Timber lands</u>.** Continue to implement Core Adaptive Management Project (CAMP3) temperature monitoring at long-term sites (Plum Creek Timber Co. 2013).

1.3.2 **<u>Supply cold water</u>**. The FMO habitat in the mainstem of the middle Clark Fork River is exceptionally warm and could benefit greatly from additional cold water infusion. Consolidating habitat gains in the upper Clark Fork basin and its major tributary systems (Rock Creek, Blackfoot River, and Bitterroot River) and conserving more cold water to be directed downstream, through acquisition, irrigation efficiency, or development of new sources is critical in at least maintaining the status quo in the face of changing climatic circumstances. Support implementation of the Confederated Salish and Kootenai Tribes (CSKT) Water Compact as one such opportunity.

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

2.1.1 <u>Improve Albert Creek passage</u>. Remove two barriers and a diversion structure on Albert Creek.

2.1.2 <u>Improve Cedar Creek instream flow including mine site restoration</u>. Develop a stream channel and mine site restoration project to re-establish perennial flow in the dewatered section of Cedar Creek near the mouth of Oregon Gulch.

2.2 Fisheries Management

2.3. Small Population Size

2.3.1 <u>Continue to emphasize systemwide connectivity</u>. Emphasize continued maintenance and improvement of existing patches of cold water SR habitat and enhancement of connectivity for fluvial and adfluvial fish from Lake Pend Oreille to access those SR tributaries.

3. Actions to Address Nonnatives

3.1 Nonnative Fish

3.1.1 **Reduce nonnative fish in Fish Creek.** Consider management actions that reduce numbers and distribution of nonnative trout (brook and brown trout) to benefit bull trout in the Fish Creek watershed.

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.2 Demographics

4.3 Nonnatives

Conservation Recommendations

2.3.2 Incorporate survey data into Middle Clark Fork River threats assessment. Evaluate whether a self-reproducing migratory population is established or maintained in the Middle Clark Fork River core area (connected to and spawning in all suitable tributary streams, and sufficiently robust to maintain demographic and genetic viability).

4.1.1 Conduct post-fire fish population monitoring in West Gold Creek. Survey fish populations in West Fork Gold Creek to evaluate ongoing impacts of the 2003 Mineral-Primm fire.

4.1.2 Evaluate grazing sites on Plum Creek Timber lands. Continue to implement Core Adaptive Management Project (CAMP 4) – revisiting long-term grazing research sites to collect biological data on fish, benthic macroinvertebrates, and periphyton (Plum Creek Timber Co. 2013).

4.1.3 Conduct 15-year review of Plum Creek HCP. Collect the necessary effectiveness monitoring data to enable reporting of metrics for the 15-year review in 2016 (Plum Creek Timber Co. 2013).

Lower Clark Fork Geographic Region
Lake Pend Oreille Core Area (Complex)

Recovery tasks that address primary threats are bolded.

This core area is discussed in three segments in order to simplify interpretation and clarify jurisdictional issues. LPO-A is the portion in Montana upstream of Cabinet Gorge Dam; LPO-B is the lake basin itself (downstream to Albeni Falls Dam) and direct tributaries, nearly all in Idaho; LPO-C is the portions of Idaho and northeast Washington from Albeni Falls Dam downstream to Boundary Dam just south of the Washington/British Columbia border.

Lake Pend Oreille (LPO-A) - Portions of Montana upstream of Cabinet Gorge Dam

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

1.1.1 **Revegetate deficient riparian areas.** Revegetate to restore shade and canopy, riparian cover, and native vegetation. Priority watersheds include the meadow portion of the mainstem Bull River, Rock Creek, Vermilion River, Prospect Creek, and the Jocko River.

1.1.2 **Continue to Implement Appendix B of Avista Clark Fork Settlement Agreement (CFSA) to acquire and protect upland/riparian habitat.** Continue to implement Water Resources Technical Advisory Committee (WRTAC) recommended and Management Committee (MC) approved Annual Implementation Plans to acquire and protect key riparian/upland habitat to protect bull trout spawning and rearing areas in tributaries of Cabinet Gorge and Noxon Reservoirs as identified and prioritized in the Lower Clark Fork River Drainage Habitat Problem Assessment (HPA).

1.1.3 **Re-site utility corridor and access roads and revegetate riparian.** Work with BPA to identify access roads that are not needed for future management and mitigate riparian roads to reduce sediment.

1.1.4 **Re-site Cooper Gulch utility corridor and revegetate riparian area.** Evaluate potential relocation of Northwestern Energy power line out of the riparian area in Cooper Gulch. A rigorous riparian revegetation plan should be implemented to promote shading and improve habitat along Cooper Gulch.

1.1.5 Consolidate and minimize Crow Creek road network (Prospect Creek). Implement extensive travel planning and road reductions in Crow Creek (Prospect tributary) to reduce sediment sources and improve stream temperature, channel habitat and riparian conditions (USFS 2013).

1.1.6 Consolidate and minimize Dry Creek road network (Prospect Creek). Implement extensive travel planning on the main Dry Creek Road, including examination of an alternative to obliterate the road completely. If not feasible, major design changes, including realignment of the road away from Dry Creek, should be implemented (USFS 2013).

1.1.7 Consolidate and minimize Clear Creek road network (Prospect Creek). Implement BMPs and consider areas for relocation along the main Clear Creek road to reduce sedimentation and address road/stream interface issues (planning currently underway).

1.1.8 Consolidate and minimize Thompson River road network. Pursue consolidation of the parallel road systems along the Thompson River.

1.1.9 Consolidate and minimize Deerhorn Creek road network (Thompson River). Work cooperatively with Plum Creek to manage and minimize the road system to reduce sedimentation and improve riparian conditions.

1.1.10 Consolidate and minimize West Fork Thompson River road network. Consolidate and manage the road system in Four Lakes Creek, Anne Creek & upper headwaters of the West Fork Thompson River (especially in riparian areas) to reduce sediment delivery and improve riparian conditions.

1.1.11 Consolidate and minimize Fishtrap Creek road network (Thompson River). Implement USFS road decommissioning and storage activities, authorized under the Fishtrap Project, to reduce sediment levels in the West Fork Fishtrap Creek, Beartrap, and Radio Creek (USFS 2013).

1.1.12 Consolidate and minimize Beatrice and Jungle Creek road network (Thompson River). Work cooperatively with Plum Creek Timber Company on a travel management plan in the Beatrice and Jungle Creeks watersheds to reduce sedimentation into Fishtrap Creek (Thompson River drainage) (USFS 2013).

1.1.13 **Consolidate and minimize Big Rock Creek road network (Thompson River).** Assess the road system on all ownerships in Big Rock Creek to identify priorities to reduce sediment delivery and improve stream temperatures, channel habitat and riparian conditions.

1.1.14 **Maximize implementing Plum Creek HCP in Thompson River watershed.** Partner with Plum Creek Timber Company (PCTC) to assess habitat quality and identify opportunities to directly improve bull trout habitat quality in the Thompson River drainage.

1.1.15 **Conduct riparian restoration on Plum Creek Timber lands.** Continue maintenance of the Thompson River riparian restoration projects, and restore floodplain hydrology on Mudd Creek by removing road fill material (Plum Creek Timber Co. 2013).

1.1.16 **CSKT will enhance Jocko River tributary habitat.** Using both passive and active management actions emphasize restoration of fish habitat in tributaries of the Jocko River watershed, including fish passage. Focus initially on Valley Creek and its tributaries and then on Finley Creek.

1.1.17 **CSKT will restore riparian and instream habitat in the mainstem Jocko River.** Protect key areas (of the Jocko River) along mainstem Reaches 1, 2, and 4 and the lower part of Reach 5, by purchasing lands from willing sellers, and then protecting the remaining lands with conservation easements.

1.2. Instream Impacts

1.2.1 **Improve instream habitat.** Increase or improve instream habitat by restoring recruitment of large woody debris, restoring pool development, or by initiating other appropriate activities in critical habitat streams.

1.2.2 **Continue to Implement Appendix B of the Avista CFSA to improve and restore instream habitat.** Continue to implement WRTAC recommended and MC approved Annual Implementation Plans to improve and restore degraded instream habitat to protect bull trout spawning and rearing areas in tributaries of Cabinet Gorge and Noxon Reservoirs as identified and prioritized in the Lower Clark Fork River Drainage Habitat Problem Assessment (HPA).

1.2.3 **Consolidate and minimize Thompson River road network.** Pursue consolidation of the parallel road systems along the Thompson River.

1.2.4 Protect and enhance Thompson River bull trout FMO corridor. Conduct habitat improvement projects which would enhance overwintering habitat and security for adult bull trout at all times of the year from Fishtrap Creek downstream to the mouth.

1.3. Water Quality

1.3.1 Implement Atlantic Richfield Corporation mitigation on Flathead Indian Reservation. Implement Confederated Salish and Kootenai Tribes/Atlantic Richfield Corporation settlement to improve water quality in Flathead Reservation streams.

1.3.2 Reduce reservoir operational impacts. Continue to implement FERC approved operating limitations for Cabinet Gorge and Noxon Reservoirs established in the CFSA.

1.3.3 Reduce gas entrainment which causes supersaturation conditions potentially detrimental to bull trout at mainstem Clark Fork dams.

1.3.4 Restore instream LWD in Prospect Creek. Assess the potential to construct large woody debris jams on National Forest and private lands along Prospect Creek to improve fish habitat and reduce temperatures.

1.3.5 Continue stream temperature monitoring on Plum Creek Timber lands. Continue to implement Core Adaptive Management Project (CAMP3) temperature monitoring at long-term sites.

1.3.6 Supply cold water. The primary prescription to address climate change in the Lower Clark Fork River is to continue to strengthen connectivity and consolidate habitat gains in headwater SR tributaries while seeking to direct more sources of cold water into the mainstem Clark Fork River FMO habitat, through acquisition, irrigation efficiency, or development of new sources.

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

2.1.1 Avista and partners will continue to collect adult bull trout below Cabinet Gorge Dam and transport them upstream to natal tributaries in Montana. As recommended by the WRTAC and approved by the MC, continue to utilize a variety of methods to collect adult bull trout below Cabinet Gorge Dam; use the Fish Handling Facility at the Cabinet Gorge Fish Hatchery to hold fish prior to transport; use genetics to identify natal stream of origin; and use approved methods for transport, timing and release locations to provide safe, timely and efficient upstream transport.

2.1.2 **Avista and partners will improve upstream passage at Cabinet Gorge Dam.** Once the CFSA amendment is complete and approved by the MC, utilize Design Review Team (DRT) recommendations for the fishway; complete final design, state and federal permitting and FERC license amendments. As approved by the MC construct, operate and evaluate the Cabinet Gorge fish passage facility.

2.1.3 **Avista and partners will improve upstream passage at Noxon Rapids Dam.** Continue to implement the Fish Pathogen Ad Hoc Committee recommendations and Montana Law on fish disease testing and fish transport guidelines; phase design and construction of the Noxon Rapids fish passage facility based on performance of the Cabinet Gorge fish passage facility in meeting bull trout upstream passage goals and meeting Montana's pathogen concerns; if warranted and approved by the MC, complete final DRT approved design, state and federal permitting and FERC license amendments; construct, operate and evaluate the Noxon Rapids fish passage facility.

2.1.4 **Avista and partners will continue to transport and evaluate downstream transportation of juvenile bull trout.** As recommended by the WRTAC and approved by the MC, continue to capture juvenile bull trout from Montana tributary streams and transport them downstream for release in the Clark Fork River below Cabinet Gorge Dam; and continue to evaluate the contribution of both transported and non-transported juvenile bull trout to adult escapement.

2.1.5 **Avista and partners will evaluate performance of the Graves Creek permanent weir and investigate additional permanent tributary trapping facilities.** As recommended by the WRTAC and approved by the MC, continue to evaluate the design and performance of the Graves Creek weir and trap for capturing adult and juvenile bull trout. Continue to use an adaptive management approach to select other permanent tributary trapping sites based on the performance of the Graves Creek permanent weir, site specific physical conditions (hydraulic, instream and riparian), and jurisdictional limitations (land ownership and permitting) at other Appendix C tributary trapping sites.

2.1.6 **<u>CSKT will implement and monitor active fish screening and passage projects on the FAID canals</u>.** Bull trout passage at Jocko "S" canal and Jocko "K" canal should continue to be evaluated and improved.

2.1.7 **<u>Northwestern Energy and partners will operate Thompson Falls Fishway to maximize upstream returns from Noxon Reservoir</u>.** Continue collaboration with MFWP to operate fishway on Thompson Falls Dam in partnership with Northwestern Energy.

2.1.8 **<u>Northwestern Energy and partners will oversee and fund Thompson Falls Fishway operations</u>.** Continue existing operations and reporting at Thompson Falls Fishway per FERC conditions and consistent with the Service's biological opinion.

2.1.9 **<u>Northwestern Energy and partners will develop and implement passage action plan and generate annual passage estimates at Thompson Falls Dam</u>.** Continue existing operations and reporting at Thompson Falls Fishway per FERC conditions and consistent with the Service's biological opinion.

2.1.10 **<u>Northwestern Energy and partners will develop revised fishway operations plan(s) every 5 years, as needed, at Thompson Falls Dam</u>.** Continue reporting and planning per FERC conditions and consistent with the Service's biological opinion.

2.1.11 **<u>Northwestern Energy and partners will participate in seamless systemwide fish passage coordination in the lower Clark Fork River</u>.** Continue existing operations and reporting at Thompson Falls Fishway per FERC conditions and consistent with the Service's biological opinion.

2.1.12 **<u>Upgrade problem roads on Plum Creek Timber lands</u>.** Continue upgrading fish passage on all remaining Plum Creek road crossings to meet the 2015 Native Fish Habitat Conservation Plan deadline.

2.2. Fisheries Management

2.2.1 <u>Continue to Implement Appendices B, and D of Avista CFSA</u>. Continue to implement WRTAC recommended and MC approved Annual Implementation Plans for Appendix B fish population monitoring in Montana tributaries and reservoirs and continue to implement the Appendix D Bull Trout Education and Enforcement Program in Montana.

2.3. Small Population Size

3. Actions to Address Nonnatives

3.1 Nonnative Fish

3.1.1 **Avista and partners will evaluate the East Fork Bull River nonnative fish suppression project and the potential for other nonnative fish suppression projects.** As recommended by the WRTAC and approved by the MC, continue to determine if techniques to remove nonnative fish species are effective in achieving long-term, population level benefits to bull trout; work with MFWP to complete Montana Environmental Policy Act (MEPA) requirements for other tributary nonnative suppression proposals.

3.1.2 **Northwestern Energy and partners will conduct Thompson Falls Reservoir assessment** aimed at determining the pattern and timing of bull trout use and assessing potential interaction with nonnative predator fish.

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.1.1 Continue to implement research, monitoring, and evaluation tasks under Appendix B of the Avista CFSA and Appendix C Fish Passage/NSRP. As recommended by the WRTAC and approved by the MC, continue to evaluate the benefit of habitat improvement projects by assessing changes in fish densities through electrofishing and snorkeling surveys.

4.1.3 Northwestern Energy and partners will continue annual adaptive management funding and conduct upstream offsite mitigation per MOU upstream of Thompson Falls Dam.

4.2 Demographic

4.2.3 Continue project area bull trout abundance monitoring in Montana tributaries within the Avista Project area. As recommended by the WRTAC and approved by the MC, continue to assess changes in bull trout abundance associated with habitat restoration activities.

4.2.5 Avista and partners will conduct bull trout and brown trout redd counts in Montana tributaries within the Avista Project area. As recommended by the WRTAC and approved by the MC, continue to conduct annual bull and Brown Trout redd counts and report tributary specific counts.

4.2.7 Northwestern Energy and partners will support scientific oversight by a Technical Advisory Committee (TAC); developing a comprehensive Phase 2 scientific report by the end of 2020.

4.3 Nonnatives

Conservation Recommendations

2.3.1 Incorporate survey data into Lake Pend Oreille core area threats assessment for LPO-A area. Evaluate whether a self-reproducing migratory populations is established or maintained in the LPO-A Area upstream of Cabinet Gorge Dam (including the Lower Flathead River tributaries) (connected to and spawning in all suitable tributary streams, and sufficiently robust to maintain demographic and genetic viability.

4.1.2 Conduct limiting factors analysis. Investigate limiting factors for native fish within select Lower Clark Fork tributaries. Quantify and develop management actions to benefit native species.

4.1.4 Evaluate Big Rock Creek to determine whether bull trout population is at least partially migratory and, if so, assess habitat needs in Big Rock Creek and mainstem FMO between Big Rock and Fishtrap creeks.

4.1.5 Evaluate grazing sites on Plum Creek Timber lands. Continue Core Adaptive Management Project (CAMP 4) – revisit long-term grazing research sites to collect biological data on fish, benthic macroinvertebrates, and periphyton (Plum Creek Timber Co. 2013).

4.1.6 Conduct 15-year review of Plum Creek HCP. Collect the necessary effectiveness monitoring data to enable reporting of metrics for the 15-year review in 2016.

4.2.1 CSKT will assess recruitment value of the lower Flathead River and its major tributaries. Continue to conduct redd counts in Post Creek drainage and Jocko River drainage.

4.2.2 CSKT will consider reintroduction of bull trout where extirpated. Evaluate and make recommendations concerning potential benefits of fish passage around, or establishment of bull trout populations upstream of natural or human barriers as a way to conserve genetic diversity in existing bull trout populations.

4.2.4 Avista and partners will continue reservoir monitoring. Continue reservoir monitoring to track the nonnative fish populations and their relative abundance within Noxon and Cabinet Gorge reservoirs.

4.2.6 Northwestern Energy and partners will conduct bull trout genetic testing and permanent tagging associated with operations of the Thompson Falls Dam fishway and project area waters upstream.

4.2.8 Northwestern Energy and partners will assess potential for bull trout occupancy in Mudd Creek, Alder Creek, Murr Creek, Lazier Creek, Twin Lakes Creek, and Indian Creek in the Thompson River drainage.

4.2.10 Improve knowledge of distribution and life history forms. Upstream of Cabinet Gorge, Noxon Rapids, and Thompson Falls Dams many potentially suitable patches of cold water habitat that could be occupied by bull trout (Isaak *et al* 2015) are seasonally or perennially disconnected, due largely to residual geologic structure from Glacial Lake Missoula. These conditions are exacerbated by human activities and changing hydrologic regimes. Some cold water patches may contain resident bull trout populations or stranded remnants of past migratory runs. Some sites are high priorities for additional presence/absence survey mapping, potentially using new e-DNA survey techniques. This will better enable restoration projects to target improved connectivity amongst functioning cold water patches and facilitate work toward restoring better connectivity for preserving and enhancing remnants of the migratory life history form.

4.3.1 Avista and partners will investigate further suppression of nonnatives. Initiate MEPA to investigate the potential to exclude upstream movement of nonnative species from key bull trout streams that contain Appendix C trapping efforts.

Lake Pend Oreille (LPO-B) - Portions of north Idaho contiguous with the basin of LPO

Recovery tasks that address primary threats are bolded.

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

1.1.1 **Revegetate deficient riparian areas.** Revegetate to restore shade and canopy, riparian cover, and native vegetation. Priority watersheds include Lightning Creek and Pack River.

1.1.2 **Continue to Implement Appendix A of Avista CFSA to Acquire and Protect Upland/Riparian Habitat.** Continue to implement annual WRTAC recommended and MC approved Annual Implementation Plans to protect key riparian/upland habitat through acquisitions and easements to protect critical bull trout spawning and rearing habitat in tributaries to Lake Pend Oreille.

1.2. Instream Impacts

1.2.1 Continue to Implement Appendix A of the Avista CFSA to Improve and Restore Instream Habitat. Continue to implement WRTAC recommended and MC approved Annual Implementation Plans to improve and restore degraded instream habitat to protect bull trout spawning and rearing areas in tributaries of Lake Pend Oreille.

1.3. Water Quality

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

2.2. Fisheries Management

2.3. Small Population Size

3. Actions to Address Nonnatives

3.1 Nonnative Fish

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.1.1 Evaluate and prioritize persistency and resiliency of cold water patches. The Lake Pend Oreille adfluvial bull trout population is robust despite the limited extant amount of cold water SR habitat. Projections for likely persistence in the future from direct tributaries to Lake Pend Oreille are marginal (see Climate Shield discussion). The existing high quality cold water rearing habitat in the lake as well as groundwater sources are not adequately accounted for in the current version of the Climate Shield model. In order to maximize the persistence of functioning SR habitats, additional investigations should be conducted to inform priorities for maintaining the status quo in the face of changing climate.

4.2 Demographic

4.3 Nonnatives

Conservation Recommendations

1.3.1 Reduce reservoir operational impacts. Review reservoir operational concerns (*e.g.*, water level manipulation) in Lake Pend Oreille and provide operating recommendations through the Federal Energy Regulatory Commission license (Cabinet Gorge Dam) and/or Federal consultation for Lake Pend Oreille (Albeni Falls).

1.3.2 Avista will work to reduce gas entrainment which causes supersaturation. Total dissolved gas reduction and monitoring will continue at Cabinet Gorge Dam as recommended by the WRTAC and approved by the MC in Annual Implementation Plans under Appendix F5 of the CFSA.

1.3.3 Maintain and supplement sources of cold water. Investigate and pursue any additional sources to enhance cold water. A possible cold water source is under study to supplement flows in the Priest River (and potentially downstream in the Pend Oreille River) by siphoning the colder hypolimnial waters of Priest Lake to discharge into the Priest River. Strengthen connectivity and consolidate habitat gains in headwater SR tributaries while seeking to direct more sources of cold water into the SR tributaries, through acquisition, irrigation efficiency, or development of new sources.

2.1.1 Implement Federal Power Act mitigation through BPA for Albeni Falls Dam. Fully mitigate fish losses related to construction and operation of federally licensed and operated hydropower projects.

2.2.1 Minimize bull trout bycatch mortality. IDFG and contractors will minimize bull trout by-catch mortality related to the lake trout netting program through use of adopted best management practices; evaluate impacts of the netting program on the bull trout population.

2.2.2 Partners will conduct education and outreach. Educate anglers on fish identification to reduce unintentional harvest of bull trout. Increase enforcement to reduce intentional harvest (Appendix D).

2.2.3 IDFG will seek to restore bull trout angling opportunity in Lake Pend Oreille. Restore a bull trout harvest fishery of at least 200 fish annually while meeting recovery plan criteria.

2.3.1 Incorporate survey data into Lake Pend Oreille core area threats assessment for LPO-B area. Evaluate whether a self-reproducing migratory population is established or maintained in Lake Pend Oreille (connected to and spawning in all suitable tributary streams, and sufficiently robust to maintain demographic and genetic viability).

3.1.1 Suppress lake trout in Lake Pend Oreille. Continue assessment of predator–prey interactions in mainstem reservoirs and Lake Pend Oreille. In Lake Pend Oreille, continue to evaluate the threat of lake trout and adaptively adjust methodology, using commercial-type fishing gear, to reduce lake trout numbers.

4.2.1 IDFG and partners will conduct redd counts. Maintain annual bull trout redd counts in 20 tributary streams to monitor the status and health of the population and the ability to meet recovery plan criteria. Monitor juvenile abundance in tributary streams to evaluate effectiveness of tributary protection and enhancement efforts.

4.2.2 Evaluate bull trout stock diversity. Gather additional biological information on bull trout where stock specific differences in age or size at maturity may influence harvest regulations or meeting recovery plan goals.

Lake Pend Oreille (LPO-C) - Portions of Idaho and Northeast Washington Downstream of Albeni Falls Dam to Boundary Dam

Recovery tasks that address primary threats are bolded.

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

1.1.1 **Seattle City Light, Pend Oreille PUD (POPUD), and partners will improve habitat through acquisitions and easements.** Use acquisition and/or conservation easements with willing landowners or other measures in bull trout critical habitat watersheds to prevent degradation.

1.1.2 **Seattle City Light, POPUD, Forest Service and partners will improve habitat within streams through restoration actions and fencing**. Implement measures defined in the updated Forest Plan and FERC licenses to improve riparian habitat and sedimentation within streams identified as potential local populations (Appendix I). Work with local partners and funding sources, including but not limited to, the tribe, WDFW, Salmon Recovery Funding Board, County, and property owners, to implement restoration actions within suitable tributary streams improving riparian conditions, LWD, and pool formation.

1.2. Instream Impacts

1.2.1 **WDFW and partners will address mining impacts in Sullivan Creek.** Minimize or eliminate impacts of dredging and sluicing within Sullivan Creek.

1.2.2 **Seattle City Light, POPUD, Forest Service, and partners will improve instream conditions restoration actions including but not limited to channel improvement floodplain connectivity, and floodplain restoration.** Implement measures defined in the updated Forest Plan and FERC licenses to improve instream habitat.

1.3. Water Quality

1.3.1 **Seattle City Light, USACOE, and partners will manage water temperatures to support adfluvial migration through the Pend Oreille River and to tributaries between Boundary and Albeni Falls Dams**.

Restore, enhance, and create thermal refugia in reservoir(s) and mouths of tributaries to provide thermal microhabitats that can be used to avoid elevated river temperatures. Maximize cooling of the Pend Oreille River during late-summer/early-fall with adaptive management of water releases from Albeni Falls Dam.

1.3.2 **USACOE, POPUD, and Seattle City Light will reduce gas entrainment** which causes supersaturation conditions believed to be detrimental to bull trout at Albeni Falls, Boundary, and Box Canyon dams.

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

2.1.1 **Pend Oreille PUD and partners will remove Mill Pond Dam.** The PUD, in partnership with Seattle City Light will remove Mill Pond Dam and the associated log crib dam, manage sediment, restore the Sullivan Creek stream channel, implement site restoration measures for the affected area, and conduct long-term monitoring and maintenance. This dam removal and restoration has already been required by FERC under the Pend Oreille PUD's surrender of its license to operate the Sullivan Project.

2.1.2 **USFS and partners will remove historic water diversions and log crib dams on LeClerc Creek** and the upper West Branch LeClerc Creek.

2.1.3 **USACOE, POPUD, and partners will improve passage and minimize entrainment issues at Albeni Falls and Box Canyon Dams.** Provide safe, timely and effective fish passage (both upstream and downstream) for bull trout at Albeni Falls and Box Canyon dams.

2.1.4 **Seattle City Light and partners will reduce entrainment issues at Boundary Dam.** Seattle City Light will develop entrainment reduction strategies to reduce or eliminate loss of individuals over Boundary Dam.

2.1.5 **Pend Oreille PUD, Seattle City Light, Kalispel Tribe, and others will improve passage and entrainment issues in tributary streams.** Provide fish passage at the Calispell Creek Pumping Plant, Calispell Duck Club Dam, and other barriers identified in regional barrier assessment for streams designated as critical habitat.

2.1.6 **Maintain and enhance connectivity of cold water patches**. Downstream of Albeni Falls and Box Canyon Dams cold water habitat is limited, but some patches persist in tributaries (*e.g.*, LeClerc Creek (Box Canyon pool), Sullivan Creek (Boundary Pool), and others) which may, over time and with habitat improvement, support migratory bull trout. Maximizing the scope, resiliency, and connectivity of these patches is important in maintaining the migratory life history form in the portion of the LPO-C (downstream of Albeni Falls Dam).

2.2. Fisheries Management

2.3. Small Population Size

2.3.1 **The Service, Seattle City Light, and partners will investigate re-introducing extirpated local populations.** Re-establishment of local populations within portions of LPO-C will require the use of translocation and potentially artificial propagation (Dunham *et al.* 2014). Constructing a regional (downstream of Albeni Falls Dam) native conservation facility (SCL 2013) is necessary to facilitate holding, propagation, and improvement of populations in the region. The Service will facilitate reintroduction efforts with funding of responsible parties, landowners, and other partners to determine appropriate streams, source stocks, and timing.

2.3.2 **The Service and partners will investigate the potential for an experimental population in Sullivan Lake and its tributaries.**

3. Actions to Address Nonnatives

3.1 Nonnative Fish

3.1.1 **WDFW and partners will suppress nonnative predators and competitors in important portions of the lower Pend Oreille River and tributaries.** Utilize chemical, mechanical, or other means to control populations of predating and competing northern pike, smallmouth bass, and walleye for the purpose of enhancing bull trout populations.

3.1.2 **WDFW and partners will suppress/eradicate competing and interbreeding nonnative brook trout from prioritized tributaries of the Pend Oreille River.** Utilize chemical, mechanical, or other means to control populations of brook trout for the purpose of enhancing bull trout populations. Work with partners to prioritize suppression and eradication efforts.

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.2 Demographic

4.2.1 Complete a Pend Oreille River bull trout reintroduction feasibility analysis and framework for the Pend Oreille River downstream of Albeni Falls Dam, to determine limiting factors for reintroduction, identify source populations, and potential for success.

4.3 Nonnatives

4.3.1 Develop Pend Oreille River native salmonid conservation plan in northeast Washington, including bull trout.

Conservation Recommendations

2.2.1 WDFW, IDFG, and partners will prevent illegal introductions. Enforce policies for preventing illegal transport and introduction of nonnative fishes.

2.2.2 Suppress nonnatives through angling. Implement mandatory catch and kill for northern pike and walleye.

2.2.3 Eliminate creel limit on brook trout.

2.3.3 Incorporate survey data into Lake Pend Oreille core area threats assessment for LPO-C area. Evaluate whether a self-reproducing migratory population is established or maintained in the Lake Pend Oreille core area downstream of Albeni Falls Dam (connected to and spawning in all suitable tributary streams, and sufficiently robust to maintain demographic and genetic viability).

Priest Lakes Core Area (Complex)

Recovery tasks that address primary threats are bolded.

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

1.1.1 IDFG and partners will improve tributary uplands and riparian. Work with the Forest Service, Kalispel Tribe, and Idaho Department of Lands to improve habitat conditions in tributary streams.

1.2. Instream Impacts

1.2.1 Improve instream habitat. Increase or improve instream habitat by restoring recruitment of large woody debris and pool development. Priority watersheds include the Hughes Fork, Gold, and Granite Creeks.

1.3. Water Quality

1.3.1 Focus water quality remediation efforts on TMDLs. Rapidly implement total maximum daily load programs for impaired water bodies that contain bull trout (section 303[d] list includes Kalispell, Trapper, and Two Mouth Creeks).

1.3.2 Supply cold water. The primary prescription to address climate change in Priest Lakes Core Area is to continue to strengthen connectivity and consolidate habitat gains in headwater SR tributaries while seeking to secure sources of cold water in the SR tributaries.

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

2.1.1 Assess and eliminate culvert barriers. Monitor road crossings for blockages to upstream passage, and, where beneficial to native fish, replace or improve existing culverts that impede passage.

2.2. Fisheries Management

2.2.1 Aggressively protect remaining Upper Priest Lake native species complex. Maximize efforts to suppress lake trout from Upper Priest Lake. Continue to manage Upper Priest Lake to minimize nonnative fish populations by using aggressive protective regulations for native species, liberal limits on nonnatives, and information and education campaigns.

2.3 Small Population Size

3. Actions to Address Nonnatives

3.1 Nonnative Fish

3.1.1 Continue suppression of lake trout from Upper Priest Lake and prevent reinvasion. Maintain yearly removal of lake trout from Upper Priest Lake and prevent re-establishment through the Thorofare.

3.1.2 Suppress lake trout in Priest Lake. Significantly reduce lake trout in Lower Priest Lake with liberal harvest limits and other means, such as commercial gillnets or trap nets.

3.1.3 Suppress brook trout. Utilize chemical, mechanical, or other means to control populations of brook trout where they coexist with bull trout local populations and within FMO habitat to prevent future brook trout range expansion.

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.2 Demographic

4.3 Nonnatives

Conservation Recommendations

2.3.1 Incorporate survey data into Priest Lakes core area threats assessment. Evaluate whether a self-reproducing migratory population is established or maintained in the Priest Lakes core area (connected to and spawning in all suitable tributary streams, and sufficiently robust to maintain demographic and genetic viability).

4.2.1 Improve knowledge of distribution. The existing SR tributaries in the Upper Priest basin are high priorities for additional presence/absence survey mapping, potentially using new e-DNA survey techniques. A similar survey of direct tributaries to Priest Lake, especially those with cold water, would further indicate where remnant bull trout populations may remain. This information would better enable restoration projects to target improved connectivity amongst cold water patches and work toward restoring the adfluvial life history form.

4.3.1 Evaluate extent of hybridization between bull trout and brook trout. Conduct genetic analyses in bull trout local populations where brook trout are firmly established. The priority should be to determine if hybridization has occurred and the extent of hybridization, along with continued trend analysis of the distribution and populations of both species.

Flathead Geographic Region
Flathead Lake Core Area (Complex)

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

1.1.1 Conserve existing habitat and support passive restoration. Long-term habitat protection is in place for much of the Middle Fork and North Fork headwaters (Bob Marshall and Great Bear Wilderness and Glacier National Park) which comprise the largest interconnected network of cold water SR habitat in the recovery unit. Passive restoration should continue in order to consolidate habitat gains in the managed portions (west side) of the North Fork and its British Columbia headwaters.

1.2. Instream Impacts

1.2.1 Improve productivity and stability of the Flathead Lake fish community by restoring habitat quality. Improve tributary passage and minimize nonnative species (*i.e.*, brook trout) in potential tributary SR habitat.

1.2.2 USBOR will follow VARQ (variable discharge) flood control procedures at Hungry Horse to balance refill with downstream flow. Maintain minimum flows all year for bull trout with a sliding scale based on the forecast. Operate to meet minimum flows of 3200 to 3500 cubic feet per second (cfs) at Columbia Falls on the mainstem Flathead River and 400 to 900 cfs in the South Fork Flathead River (downstream of dam). Provide even or gradually-declining flows during summer months (minimize double peak). Limit outflow fluctuations by operating to ramping rates set in the 2000 Service Biological Opinion to avoid stranding bull trout.

1.3. Water Quality

1.3.1 USBOR will limit spill at Hungry Horse to maximum of 15 percent of outflow to avoid exceeding Montana State total dissolved gas standards of 110 percent.

1.3.2 Supply cold water. The primary prescription to address climate change in the Flathead Core Area is to continue to strengthen connectivity and consolidate habitat gains in headwater SR tributaries while seeking to secure sources of cold water in the SR tributaries.

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

2.2. Fisheries Management

2.2.1 **Management agencies will continue protective angling regulations for Flathead Lake bull trout.** Continue yearlong angling closures for all fish on primary bull trout spawning streams and closure on angling for bull trout in the Flathead River and Forks.

2.2.2 **Flathead Lake co-managers will suppress nonnative fish through recreational angling.** Suppress abundance of nonnative fish through recreational/subsistence fishing and liberal bag limits while protecting native fish through restrictive fishing regulations. In Flathead Lake, suppression will focus on reducing numbers of lake trout.

2.2.3 **Remove the lake trout slot limit to encourage suppression in Flathead Lake.** Change the regulations to make it legal to keep lake trout from 30 to 36 inches long.

2.2.4 **Flathead Lake co-managers will conduct educational outreach.** Education efforts would continue both online and directly with anglers to improve identification of bull trout, especially juvenile characteristics.

2.3. Small Population Size

3. Actions to Address Nonnatives

3.1 Nonnative Fish

3.1.1 **Revise and implement an updated Flathead Lake and River Co-Management Plan** so that it accommodates bull trout recovery goals and minimizes the emigration of lake trout both upstream and downstream through the Flathead River system. Monitor and evaluate the effectiveness of the management plan in meeting bull trout recovery goals and make adaptive changes, if necessary. Continue assessment of predator–prey interactions in Flathead Lake, with emphasis on lake trout.

3.1.2 **CSKT will adopt EIS Alternative D, a comprehensive strategy to suppress nonnative lake trout in Flathead Lake.** Adopt EIS Alternative D to reduce the population of adult lake trout (age 8 and older) in Flathead Lake by 75 percent relative to the 2010 levels, within 50 years, which means an annual harvest target of 143,000 lake trout age 4 and above (the actual harvest could range between 129,000 and 157,000 fish).

3.1.3 **<u>CSKT will use multiple tools to suppress nonnative lake trout in Flathead Lake</u>.** Alternative D would accomplish goals by continuing and expanding Mack Days and when necessary adding a mix of tools such as bounties, commercial fishing, targeted gillnets, and trap nets to reach and maintain their respective reductions in adult lake trout numbers. Bull trout mortality would be limited to the levels identified in predetermined bycatch tables and would have to be permitted under the Act by the Service (CSKT 2014).

3.1.4 **<u>Increase suppression of nonnative lake trout, if necessary, through commercial harvest in State-managed waters</u>.** This task, identified by CSKT but, to date, not adopted by MFWP would require legislation to implement lake-wide. Establish hook and line commercial angling for lake trout, pay bounties for harvested lake trout, or commercially net nonnative fish to reach lake-wide targets.

3.1.5 **<u>Reduce and minimize northern pike in the Flathead River</u>.** Evaluate and, if warranted, control expansion of northern pike in the Flathead River and associated sloughs or other waters to minimize predation on bull trout.

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.2 Demographic

4.2.1 <u>Monitor bull trout abundance in Flathead Lake</u>. Develop, refine, or continue measuring fish population parameters including: bull trout abundance trends, redd counts, and juvenile abundance.

4.2.2 <u>Monitor lake trout abundance in Flathead Lake</u>. Develop, refine, or continue measuring fish population parameters including: lake trout abundance trends, population size, structure, and mortality rates. Quantify predation and competition between species.

4.2.3 <u>Monitor abundance and trends of fish in the Flathead River and major tributaries</u>. Continue to monitor the abundance of fish in Flathead River and tributaries. Emphasize monitoring in: (1) primary spawning tributaries where habitat work has been done, and (2) areas supporting bull trout.

4.3 Nonnatives

4.3.1 Evaluate and remediate cause(s) of declining bull trout redd counts in the North Fork. Further evaluate causes of recent bull trout declines in North Fork SR tributaries and identify any necessary remedies. Examine why the North Fork local populations appear disproportionately impacted relative to the Middle Fork.

Conservation Recommendations

2.3.1 Incorporate survey data into Flathead Lake core area threats assessment. Evaluate whether a self-reproducing migratory populations is established or maintained in Flathead Lake (connected to and spawning in all suitable tributary streams, and sufficiently robust to maintain demographic and genetic viability).

4.1.1 Improve capability to predict fish community response to physical and biological changes. Continue annual quantification of parameters to monitor responses to mitigation actions and gauge success in meeting abundance targets.

Simple Core Areas (n = 9) in Glacier National Park, grouped together because of similarity of threats and recovery tasks: *Upper Kintla Lake; Akokala Lake; Bowman Lake; Quartz Lakes; Logging Lake; Trout/Arrow Lakes; Isabel Lakes; Harrison Lake; and Lincoln Lake*

Recovery tasks that address primary threats are bolded.

1. Actions to Address Habitat Threats

None

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

2.1.1 Maintain natural barriers isolating GNP lakes. Stringently protect existing bull trout refugia in Upper Kintla, Trout, Arrow, and Isabel Lakes in Glacier National Park by maintaining integrity of natural barriers.

2.1.2 Construct and maintain artificial barriers downstream of some GNP lakes. Protect existing bull trout refugia in Quartz, Lower Quartz, Cerulean, and Akokala Lakes in Glacier National Park by building and maintaining artificial barrier(s) to upstream migration, minimizing potential for further illegal or accidental introduction of nonnative species.

2.2. Fisheries Management

2.3. Small Population Size

3. Actions to Address Nonnatives

3.1 Nonnative Fish

3.1.1 Minimize nonnative species transport through education and outreach. Protect existing bull trout refugia in Upper Kintla, Trout, Arrow, Isabel, Quartz, and Akokala Lakes in Glacier National Park by minimizing potential for illegal or accidental introduction of nonnative, in part through conducting educational outreach to visitors.

3.1.2 Actively suppress existing population of lake trout in Quartz Lake system in Glacier National Park with the goal of maintaining a robust bull trout population and minimizing potential for further lake trout expansion to Cerulean Lake.

3.1.3 **Suppress nonnatives to restore remnant bull trout populations to sustainable levels in Logging, Bowman, Harrison, and Lincoln Lakes in Glacier National Park.** Bull trout populations in these lakes have been seriously threatened by nonnative lake trout (and brook trout invasion in Lincoln), compromising long-term viability and genetic resources. Active suppression and/or rehabilitation, potentially coupled with long-term exclusion (barriers) are warranted (Source: Fredenberg *et al*. [2007] - Glacier Bull Trout Action Plan).

3.1.4 Continue ongoing AIS inspections of all watercraft entering GNP waters. Existing program requires mandatory check-in and should be continued in order to minimize risk of aquatic species introductions into Park lakes.

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.2 Demographic

4.3 Nonnatives

Conservation Recommendations

2.2.1 Maintain angling regulations that minimize human impacts on bull trout while maximizing take of nonnative predators and competitors. Existing fishing regulations that close certain waters to all fishing where bull trout are vulnerable and maximize angler removal of lake trout, brook trout and other nonnatives are especially important and should be maximized.

4.2.1 Conduct research to further establish baseline conditions of naturally functioning simple core areas, including demographics and life history attributes, using Upper Kintla, Trout, Arrow, Isabel, Akokala, and Quartz Lakes in Glacier National Park as controls.

Simple core areas (n = 7) in the Flathead basin outside of Glacier National Park, grouped together because of similarity of threats and recovery tasks: ***Upper Stillwater Lake; Upper Whitefish Lake; Whitefish Lake; Frozen Lake; Cyclone Lake; Doctor Lake; and Big Salmon Lake***

Recovery tasks that address primary threats are bolded.

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

1.1.1 **Conserve existing habitat and support passive restoration**. Long-term habitat protection is in place for Doctor and Big Salmon core areas (Bob Marshall Wilderness), but less so for the others. Passive restoration in each watershed should continue, with scrutiny of all new or proposed projects in order to consolidate and improve habitat gains in the managed portions.

1.2. Instream Impacts

1.3. Water Quality

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

2.2. Fisheries Management

2.2.1 **Maintain angling regulations that minimize impacts on bull trout while maximizing harvest of nonnative predators and competitors.** Fishing regulations should seek to protect SR habitat where bull trout are vulnerable and maximize angler removal of lake trout, northern pike, brook trout, and other nonnatives.

2.3. Small Population Size

3. Actions to Address Nonnatives

3.1 Nonnative Fish

3.1.1 **Consider installing barrier(s) to impede upstream spread of nonnative fish into Upper Whitefish, Frozen, and Cyclone Lakes.** Threats of invasion of isolated lakes by nonnative fish, especially lake trout from downstream, may exceed concerns over fragmentation due to barriers. Case by case evaluation should occur.

3.1.2 **Suppress nonnatives to restore remnant bull trout populations to sustainable levels in Upper Stillwater and Whitefish Lakes**. Bull trout have been seriously threatened by nonnative lake trout and northern pike in FMO of Upper Stillwater and Whitefish Lakes, with abundant brook trout compromising long-term viability and genetic resources in the SR habitat upstream. Active suppression and/or rehabilitation may be warranted, as determined on a case-by-case basis.

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.1.1 Monitor stream temperature in Whitefish, Upper Whitefish, Upper Stillwater, and Cyclone Lake watersheds. Conduct stream temperature monitoring on State lands in the Stillwater State Forest.

4.2 Demographic

4.2.1 Continue redd counts. Continue bull trout redd counts on Coal Creek State Forest (Coal Creek and Cyclone Creek).

4.3 Nonnatives

Hungry Horse Reservoir Core Area (Complex)

Recovery tasks that address primary threats are bolded – there are none in this core area.

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

1.1.1 Conserve existing habitat and continue passive restoration. With long-term habitat protection in place for much of the South Fork headwaters (Bob Marshall and Great Bear Wilderness), it functions as a virtual native species refuge. Passive restoration of habitat in the managed portions of tributary drainages to Hungry Horse Reservoir should continue, with close scrutiny of future management activities planned in Wounded Buck, Wheeler, Sullivan, and Bunker Creek SR tributaries.

1.2. Instream Impacts

1.2.1 Follow VARQ flood control procedures at Hungry Horse, balancing reservoir refill with other demands. When not operating to minimum flows, operate to achieve 75 percent probability of reaching upper rule curve (URC) elevation by about April 10. Refill by about June 30 each year (exact date to be determined during in-season management).

1.3. Water Quality

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

2.2. Fisheries Management

2.3. Small Population Size

3. Actions to Address Nonnatives

None

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.2 Demographic

4.3 Nonnatives

4.3.1 Protect native species refugium. While Hungry Horse Reservoir is an artificial lake, this core area represents the strongest functioning adfluvial bull trout and westslope cutthroat trout refugium in the entire range and should be vigilantly protected as a naturally functioning control area, isolated from introductions of nonnative species.

Conservation Recommendations

2.2.1 Provide regulated fishery in Hungry Horse Reservoir to satisfy public demand and stimulate angler support for bull trout recovery. Regulate harvest and monitor migratory populations for conservation and angling through a catch card system in Hungry Horse Reservoir and South Fork Flathead River.

2.3.1 Incorporate survey data into Hungry Horse Reservoir core area threats assessment. Evaluate whether a self-reproducing migratory population is established or maintained in Hungry Horse Reservoir (connected to and spawning in all suitable tributary streams, and sufficiently robust to maintain demographic and genetic viability).

4.2.1 Investigate opportunities for translocation. Two large cold water patches unoccupied by bull trout exist in the Spotted Bear River upstream of Dean Falls and the White River upstream of White River Falls. Neither is currently a high priority for translocation due to their locations upstream of an already robust population, but should be useful for research purposes or future range expansion.

Three (3) core areas in the Swan drainage grouped together because of similarity of threats and recovery tasks: Swan Lake Core Area (Complex); *Lindbergh Lake (Simple); and Holland Lake (Simple)*

Recovery tasks that address primary threats are bolded.

1. Actions to Address Habitat Threats

None

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

2.2. Fisheries Management

2.3. Small Population Size

3. Actions to Address Nonnatives

3.1 Nonnative Fish

3.1.1 **<u>Develop and implement a Swan Lake management strategy</u>**. Develop and implement a long-term management strategy for Swan Lake that seeks to minimize lake trout impacts by whatever means possible. Maintain Bigfork Dam as an upstream fish barrier.

3.1.2 **<u>Suppress lake trout in Swan Lake</u>.** Fully implement experimental lake trout suppression in Swan Lake while maximizing survival of non-target kokanee (an important forage buffer) and minimizing bull trout bycatch.

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.1.1 <u>Monitor stream temperature</u>. Continue stream temperature monitoring on State lands in the Swan River State Forest.

4.2 Demographics

4.3 Nonnatives

4.3.1 <u>Manage brook trout populations in SR tributaries</u>. Continue regular tributary population assessments and, if warranted, evaluate opportunities for removing brook trout from selected stream(s) to measure bull trout response. Priority watersheds include the known SR habitats of Elk, Cold, Jim, Piper, Lion, Goat/Squeezer, Woodward, and Lost Creeks.

4.3.2 Evaluate lake trout suppression in Holland and Lindbergh Lakes. Consider implementing suppression effort similar to Swan Lake (or other options) in order to maintain viable populations of migratory bull trout.

Conservation Recommendations

2.2.1 Continue protective angling regulations for Swan Lake, Lindbergh Lake, and Holland Lake bull trout. Continue to minimize incidental catch of bull trout. Maintain spawning tributary mouth closures as needed.

2.3.1 Enhance migratory populations for conservation.

2.3.2 Incorporate survey data into Swan Lake core area threats assessment. Evaluate whether a self-reproducing migratory populations is established or maintained in Swan Lake (connected to and spawning in all suitable tributary streams, and sufficiently robust to maintain demographic and genetic viability).

Kootenai Geographic Region
Kootenai River Core Area (Complex)

Recovery tasks that address primary threats are bolded.

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

1.1.1 Upgrade problem roads in Kootenai River Watershed. Pave, upgrade, or relocate portions of major access roads, including those along Fisher River, Grave Creek, and Libby Creek in Montana, to reduce impacts from sediment and remedy extensive floodplain encroachment and channel alterations.

1.1.2 Upgrade problem roads on Plum Creek Timber lands. Continue upgrading of all remaining Plum Creek roads to meet the 2015 Native Fish Habitat Conservation Plan deadline.

1.1.3 Conduct riparian restoration on Plum Creek Timber lands. Continue maintenance of the Fisher River riparian restoration projects.

1.1.4 Rehab Libby Creek mining claims. Continue to work with agencies and mining interests to improve habitat in Libby Creek and tributaries.

1.2. Instream Impacts

1.2.1 Restore stream channels in SR tributaries. Conduct stream channel restoration activities where investigation indicates such actions are likely to benefit native fish. Priority watersheds include Idaho: Boulder Creek, Boundary Creek, Cow Creek, Katka Creek, Myrtle Creek, Parker Creek, and Smith Creek; Montana: Fisher River, Grave Creek, Libby Creek, and Pipe Creek.

1.2.2 Improve instream habitat in SR streams. Increase or improve instream habitat by restoring recruitment of large woody debris, pool development, or other appropriate components in streams where investigation indicates such actions are likely to benefit native fish. Priority watersheds include all designated bull trout critical habitat; especially SR habitat.

1.2.3 **Follow VARQ (variable outflow) flood control procedures at Libby Dam.** Follow variable December 31 flood control draft based on early season water supply forecast. Operate consistent with the Columbia River Treaty, and the International Joint Commission and the 1938 Order on Kootenay Lake. When not operating to minimum flows, operate to increase flows for spring flow management. Meet minimum flow requirements for bull trout from May 15 to September 30 as described in the Service 2006 Libby Biological Opinion and 4,000 cubic feet per second (cfs) in October through May 14 for resident fish. Limit outflow fluctuations by operating to ramping rates set in the 2006 Service Biological Opinion to avoid stranding bull trout.

1.3. Water Quality

1.3.1 Continue stream temperature monitoring on Plum Creek Timber lands. Continue to implement Core Adaptive Management Project (CAMP3) – temperature monitoring at long-term sites.

1.3.2 Reduce gas entrainment at Libby Dam. Limit spill to avoid exceeding Montana State TDG standard of 110 percent, when possible, and in a manner consistent with the Action Agencies' responsibilities for Federally-listed resident fish.

1.3.3 Supply cold water. The primary prescription to address climate change in the Kootenai River Core Area is to continue to strengthen connectivity and consolidate habitat gains in SR tributaries while seeking to direct more sources of cold water into the mainstem Kootenai River FMO.

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

2.1.1 Improve Pipe Creek passage. Remove barriers to improve access by spawning BT in lower Pipe Creek.

2.2. Fisheries Management

2.3. Small Population Size

3. Actions to Address Nonnatives

3.1 Nonnative Fish

3.1.1 Remove established brook trout populations in Kootenai River SR tributaries. Evaluate opportunities for removing brook trout from selected streams and lakes. Priority watersheds include Idaho: Boulder Creek, Deep Creek; Montana: Grave Creek, O'Brien Creek, and Pipe Creek.

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.2 Demographic

4.3 Nonnatives

Conservation Recommendations

2.3.1 Incorporate survey data into Kootenai River core area threats assessment. Evaluate whether a self-reproducing migratory population is established or maintained in the Kootenai River (connected to and spawning in all suitable tributary streams, and sufficiently robust to maintain demographic and genetic viability).

4.1.1 Monitor and evaluate Kootenai River nutrient enrichment. Continue to work with Kootenai Tribe of Idaho nutrient restoration program and evaluate the effects on the fish community with emphasis on rainbow trout, bull trout and mountain whitefish.

4.1.2 Conduct experimental nutrient injection. Restore nutrients and productivity below Libby Dam.

4.1.3 Evaluate grazing sites on Plum Creek Timber lands. Continue to implement Core Adaptive Management Project (CAMP 4) – Revisit long-term grazing research sites to collect biological data – fish, benthic macroinvertebrates, and periphyton (Plum Creek Timber Co. 2013).

4.1.4 Conduct 15-year review of Plum Creek HCP. Collect the necessary effectiveness monitoring data to enable reporting of metrics for the 15-year review in 2016.

4.2.1 Improve knowledge of migratory patterns and distribution. The existing SR tributaries in the Kootenai River core area, especially Libby Creek, West Fisher and downstream tributaries in Idaho are high priorities for additional presence/absence survey mapping, potentially using new e-DNA survey techniques. Additionally, more information about connectivity to adfluvial bull trout originating in Kootenay Lake, British Columbia, would better enable restoration projects to target improved connectivity amongst cold water patches and facilitate prioritization of work toward restoring the adfluvial life history form.

Lake Koocanusa Core Area (Complex)

Recovery tasks that address primary threats are bolded – there are none in this core area.

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

1.2. Instream Impacts

1.2.1 Follow VARQ (variable outflow) flood control procedures at Libby Dam. Follow variable December 31 flood control draft based on early season water supply forecast. Operate consistent with the Columbia River Treaty, and the International Joint Commission and the 1938 Order on Kootenay Lake. When not operating to minimum flows, operate to achieve 75 percent chance of reaching the upper flood control rule curve on or about April 10 (the exact date to be determined during in-season management) to increase flows for spring flow management (NOAA 2008).

1.3. Water Quality

2. Actions to Address Demographic Threats

2.1. Connectivity Impairment

2.1.1 Improve Grave Creek passage and entrainment. Continue to work with irrigators and agencies to eliminate adult loss and reduce/eliminate fry loss in Grave Creek, through Glen Lake Irrigation District system.

2.2. Fisheries Management

2.3. Small Population Size

3. Actions to Address Nonnatives

3.1 Nonnative Fish

3.1.1 Discourage unauthorized fish introductions. Implement educational effort about the problems and consequences of unauthorized fish introductions. Continue assessment of predator and prey interactions in Lake Koocanusa and Kootenay Lake with emphasis on preventing illegal introductions of lake trout, walleye, brown trout, or other competing piscivores from nearby waters.

3.1.2 Minimize nonnative fish impacts in Lake Koocanusa. Suppress and prevent expansion of nonnative fish populations beyond current levels in Koocanusa Reservoir.

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.1.1 Monitor impacts of coal mining in British Columbia. Active development and expansion of Elk River coal fields has potential to directly threaten bull trout in this core area (selenium, runoff, and water quality concerns). These activities are being closely monitored by several governmental and nongovernmental entities, but occur in another country and outside the core area (bull trout in Canada are not listed under the Act). Actions to mitigate any harmful effects will be supported but are largely beyond the scope of this recovery implementation plan.

4.2 Demographic

4.2.1 Examine loss of connectivity of bull trout at Libby Dam. Evaluate the significance of bull trout that are entrained through Libby Dam and isolated upstream of Kootenai Falls; assess the potential impact of the loss of connectivity due to Libby Dam to the health of bull trout populations in the system.

4.3. Nonnatives

Conservation Recommendations

2.2.1 Provide regulated fishery in Lake Koocanusa to satisfy public demand and stimulate angler support for bull trout recovery. Monitor recreational fishery including by-catch by anglers fishing for large rainbow trout and during derbies.

2.2.2 Continue cooperative transboundary angling regulation evaluations for Kootenai River and Lake Koocanusa. Monitor population in Montana and work with British Columbia counterparts to establish adequate protection to ensure opportunity for angling on both sides of the border.

2.3.1 Incorporate survey data into Lake Koocanusa core area threats assessment. Evaluate whether a self-reproducing migratory population is established or maintained in Lake Koocanusa (connected to and spawning in all suitable tributary streams, and sufficiently robust to maintain demographic and genetic viability).

Bull Lake Core Area (Simple)

Recovery tasks that address primary threats are bolded.

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

1.1.1 **Conduct riparian restoration along Lake and Keeler Creek**. Maximize integrity of the riparian system along the SR and FMO corridors.

1.2. Instream Impacts

1.2.1 Improve instream habitat in Keeler Creek. Increase or improve instream habitat by restoring recruitment of large woody debris, pool development, or other appropriate components in streams where investigation indicates such actions are likely to benefit native fish.

2. Actions to Address Demographic Threats

None

3. Actions to Address Nonnatives

3.1 Nonnative Fish

3.1.1 **Evaluate suppression of existing population of nonnatives in Bull Lake** with the goal of maintaining a viable bull trout population and minimizing potential for loss of bull trout from this isolated core area. Northern pike and brown trout need to be evaluated as potential predators/competitors.

4. Research, Monitoring, and Evaluation

None

Conservation Recommendations

None

Coeur d'Alene Geographic Region

Coeur d'Alene Lake Core Area (Complex)

Recovery tasks that address primary threats are bolded.

1. Actions to Address Habitat Threats

1.1. Upland/Riparian Land Management

1.1.1 Implement CERCLA (EPA Superfund) activities in restoring upland and riparian habitat in the Coeur d'Alene basin. Implement Comprehensive Environmental Response, Compensation, and Liability Act activities in an effort to remediate or restore upland and riparian habitat impacted by mining.

1.1.2 Improve Coeur d'Alene and St. Joe River habitat. Work with Avista mitigation program (Post Falls Development Fisheries Protection and Enhancement Plan) and mine waste settlement funds to secure and improve cutthroat and bull trout habitat in the Coeur d'Alene and St. Joe Rivers.

1.2. Instream Impacts

1.2.1 Enforce and evaluate existing mining regulations. Continue enforcing mining regulations, increase inspections of operations, and modify seasons of operations. Monitor potential illegal mining areas.

1.2.2 Implement CERCLA (EPA Superfund) activities in restoring instream habitat in the Coeur d'Alene basin. Implement Comprehensive Environmental Response, Compensation, and Liability Act activities in an effort to remediate or restore instream habitat impacted by mining.

1.3. Water Quality

1.3.1 Identify sources of water temperature increases in Coeur d'Alene and St. Joe River. Identify significant sources of thermal increases in priority streams and priority water bodies, for example, effluent inflows or loss of riparian canopy, and mitigate to the extent possible.

1.3.2 Identify and protect cold groundwater sources in the Coeur d'Alene and St. Joe River watersheds. Identify and protect groundwater sources in support of local populations or priority streams.

1.3.3 **<u>Implement CERCLA (EPA Superfund) activities in remediating water quality in the Coeur d'Alene basin</u>.** Implement Comprehensive Environmental Response, Compensation, and Liability Act activities in an effort to remediate or restore areas impacted by mining.

1.3.4 **<u>Improve water quality in Coeur d'Alene tributaries</u>.** Reduce stream temperature and pollutants in tributaries to Coeur d'Alene Lake. Focus should also be given to improving low DO levels in FMO habitats.

1.3.5 **<u>Supply cold water.</u>** The primary prescription to address climate change in the Coeur d'Alene and St. Joe Rivers is an urgent need to continue to strengthen connectivity and consolidate habitat gains in headwater SR tributaries while seeking to direct more sources of cold water into the mainstem FMO, through acquisition, irrigation efficiency, or development of new sources.

2. Actions to Address Demographic Threats

2.3.1 **<u>Incorporate survey data into Coeur d'Alene Lake core area threats assessment.</u>** Evaluate whether a self-reproducing migratory population is established or maintained in the Coeur d'Alene Lake core area (connected to and spawning in all suitable tributary streams, and sufficiently robust to maintain demographic and genetic viability).

3. Actions to Address Nonnatives

3.1 Nonnative Fish

3.1.1 **<u>Develop a nonnative suppression plan for the St. Joe and Coeur d'Alene River migratory corridors and confluence with lake</u>.** Convene an interagency working group to assess threats to bull trout from various nonnative species. Review current information and identify information gaps where additional research is needed to obtain a better understanding of nonnative impacts to bull trout and develop a suppression plan.

3.1.2 **<u>Control nonnative fish in the St. Joe and Coeur d'Alene River migratory corridors and confluence with lake</u>.** Implement removal of or reduction efforts for nonnative species (northern pike, largemouth bass, smallmouth bass, chinook salmon) wherever feasible and biologically, economically, and socially supportable in Coeur d'Alene Lake and migratory corridors.

4. Research, Monitoring, and Evaluation

4.1 Habitat

4.1.3 Enhance supplies of cold water. The mainstem St. Joe and Coeur d'Alene FMO habitat is exceptionally warm in the lower reaches and bull trout in the FMO would benefit greatly from additional cold water infusion. While habitat restoration efforts strengthen connectivity and consolidate habitat gains in headwater SR tributaries, actions are needed to improve temperature regimes in the lower mainstem through potential acquisition, irrigation efficiency, or development of new sources.

4.2 Demographic

4.2.4 Evaluate potential reintroduction. The Service is committed to convening an interagency working group to conduct a biological feasibility assessment for bull trout reintroduction. Based on the outcome of the assessment, develop a reintroduction plan. Additional work should be conducted to confirm bull trout absence in the Coeur d'Alene headwaters, assess habitat suitability, and if warranted map out a reintroduction strategy using appropriate donor stock.

4.3. Nonnatives

Conservation Recommendations

4.1.1 Evaluate current and legacy land and water management effects. Determine how timber management, roads, mining, and increases in peak flow have affected bull trout habitats and identify actions to eliminate negative effects or improve conditions. Utilize the Distributed Hydrology-Soil-Vegetation Model (DHSVM) to assess management related impacts on stream flows from forest harvest and roads.

4.1.2 Complete watershed assessment. Complete water quality assessments and comprehensive watershed assessments in key watersheds and develop remedies for issues that are identified. Utilize the DHSVM model as part of the watershed assessments in key watersheds.

4.2.1 Research bull trout life history in the St. Joe River. Investigate distribution, status, critical habitat needs and survival during different stages of bull trout life cycle to better guide conservation efforts in the St. Joe River.

4.2.2 Conduct genetic analysis. Conduct genetic analysis to determine the appropriateness of adding genes from other populations to potentially refound bull trout local populations in the Coeur d'Alene River headwaters.

4.2.3 Improve knowledge of distribution. The St. Joe headwaters are a high priority for additional presence/absence survey mapping, potentially using new e-DNA survey techniques. This will better enable restoration projects to target improved connectivity amongst cold water patches and work toward restoring more of the migratory life history form.

Implementation Schedule for the Columbia Headwaters Recovery Unit

The Implementation Schedule that follows describes recovery action priorities, action numbers, action descriptions, duration of actions, potential or participating responsible parties, total cost estimate and estimates for the next 5 years, if available, and comments. These tasks, when accomplished in conjunction with implementation of recovery actions in the other bull trout recovery units, will lead to recovery of bull trout in the coterminous United States as discussed in the Bull Trout Recovery Plan (USFWS 2015a).

Parties with authority, responsibility, or expressed interest to implement a specific recovery action are identified in the Implementation Schedule. Listing a responsible party does not imply that prior approval has been given or require that party to participate or expend any funds. However, willing participants will benefit by demonstrating that their budget submission or funding request is for a recovery action identified in an approved recovery plan, and is therefore part of a coordinated effort to recover bull trout. In addition, section 7(a)(1) of the Act directs all Federal agencies to use their authorities to further the purposes of the Act by implementing programs for the conservation of threatened or endangered species.

<u>Interrelated Costs of Recovery Actions</u>

Costs of recovery in the Columbia Headwaters are, for the most part, directly attributable to bull trout since no anadromous salmonids occur in this RU. The only other listed fish is Kootenai River White Sturgeon, which occur only in the FMO habitat of the mainstem Kootenai River in a single core area. Costs are roughly proportionally shared amongst general categories of 1) habitat improvement and restoration; 2) improvements to water quality, instream flow and provision of supplemental cold water; 3) connectivity improvement over major barriers (i.e., dams); and 4) nonnative fish suppression. The first two categories reflect implementation of general land and water management stewardship and BMPs that also significantly benefit the other primary native salmonids, westslope cutthroat trout and mountain whitefish. Some actions are independently mandated and accomplished under the Clean Water Act, CERCLA, NFMA, Forest Plans, or other wide-reaching plans. Fish passage improvements are largely tied to FERC license conditions for private dams and hydropower mitigation responsibilities of the Federal Government attributable to dams operated by the Bureau of Reclamation and Corps of Engineers under the auspices of the Bonneville Power Administration. At this time recovery actions requiring nonnative fish suppression are largely unfunded under current legal mandates, but are being approached as collaborative efforts through a multitude of funding sources, including many of those named above.

The implementation schedule includes the following components:

- Core Area: Designated core area(s) where the recovery action should be targeted.

- Threat Factor: Listing factors (A through E) or threat category addressed by the action.
  A: The present or threatened destruction, modification, or curtailment of habitat or range.
  B: Overutilization for commercial, recreational, scientific or educational purposes.
  C: Disease or predation.
  D: Inadequacy of existing regulatory mechanisms.
  E: Other natural or manmade factors affecting its continued existence.

- Recovery Action Priority: Assigned # 1, 2, 3, or CR based on the following definitions;

Priority 1 – An action that must be taken to prevent extinction or prevent the species from declining irreversibly in the foreseeable future;

Priority 2 – An action that must be taken to prevent a significant decline in species population or habitat quality;

Priority 3 - All other actions necessary to meet the recovery objectives.

Priority CR - We also list additional conservation recommendations (delineated by "CR"). These actions are considered beneficial for bull trout conservation and merit implementation, but are not considered necessary to meet recovery objectives within a core area and so are not classified as Priority 1, 2, or 3. Conservation recommendations are not included in recovery cost estimates.

We evaluate action priorities relative to the core area(s) where the action is targeted. Action priorities may reflect both the severity of the threat and the expected effectiveness of the action in addressing it. Some research, monitoring and evaluation actions necessary for recovery are also deemed critical for developing information for planning, implementing, monitoring, and evaluating effectiveness of actions addressing management of primary threats. Depending on the level of importance of this information, these RM&E actions may be classified as Priority 1, 2, or 3.

Additional components of the implementation schedule are:

- Recovery Action Description: Brief descriptive title of recovery action (consistent with the Recovery Measures Narrative that precedes this section).

- Recovery Action Duration: Indicates the number of years estimated to complete the action, or other codes defined as follows: Actions that are expected to last for the life of this plan (25 years) are so designated.

- Responsible Parties: Agencies and others with responsibility or authority to implement proposed recovery actions, typically with the primary lead for implementation listed first and others in no particular order.

- Estimated Costs: Estimated costs (x $1,000) are assigned to each action identified in the Implementation Schedule, both for the first 5 years after release of the recovery plan and for the total estimated cost of recovery (based on time to recovery, for Continual or Ongoing actions).

  An asterisk (*) in the total cost column indicates ongoing tasks that are currently being implemented as part of normal agency responsibilities under existing authorities. Because these tasks are not being done specifically or solely for bull trout conservation, they are not included in the cost estimates. Some of these efforts may be occurring at reduced funding levels and/or in only a small portion of the watershed.

- Time to Recovery: Estimated time before this recovery unit could meet recovery criteria, if recovery actions are successfully implemented.

The following acronyms are used to identify responsible or participating parties throughout the implementation schedule:

Federal Agencies:

BCM	British Columbia Ministry of Water, Land, and Air Protection
BLM	Bureau of Land Management
BOR	U.S. Bureau of Reclamation
BPA	Bonneville Power Administration
COE	U.S. Army Corps of Engineers
FERC	Federal Energy Regulatory Commission
GNP	Glacier National Park (National Park Service)
NRCS	National Resources Conservation Service
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service

State Agencies:

IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish and Game
IDL	Idaho Department of Lands
IDWR	Idaho Department of Water Resources
ITD	Idaho Transportation Department
IWRB	Idaho Water Resources Board
MDEQ	Montana Department of Environmental Quality
MDNR	Montana Department of Natural Resources and Conservation
MDOT	Montana Department of Transportation
MFWP	Montana Fish, Wildlife and Parks
WADNR	Washington Department of Natural Resources
WDFW	Washington Department of Fish and Wildlife

Others:

ARCO	Atlantic Richfield Corporation
AVISTA	Avista Utilities
BNSFR	Burlington Northern and Santa Fe Railway
CSKT	Confederated Salish and Kootenai Tribes
FAID	Flathead Agency Irrigation District
FBC	Flathead Basin Commission
KT	Kalispel Tribe
LCFWG	Lower Clark Fork Watershed Group
NWE	Northwestern Energy (formerly PPLMT)
PAC	PacifiCorp
PCTC	Plum Creek Timber Company
TU	Trout Unlimited
UCFRBSC	Upper Clark Fork River Basin Steering Committee
WAGs	Idaho Watershed Advisory Groups

Table D-5. Columbia Headwaters Recovery Unit Implementation Schedule. Recovery action descriptions that address primary threats are bolded.

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Upper Clark Fork Geographic Region													
Upper Clark Fork River	A	1	**1.1.1**	**Prioritize Warm Springs and Upper Clark Fork for restoration**	25	MFWP, USFWS, BLM, PCTC, USFS		*					
Upper Clark Fork River	A	1	**1.1.2**	**Prioritize Flint, Boulder, and Harvey creeks for restoration**	25	MFWP, USFWS, BLM, PCTC, USFS		*					
Upper Clark Fork River	A	2	1.2.1	Reduce operational impacts	25	MDNRC, MFWP, BLM, NRCS, USFS, USFWS		250	10	10	10	10	10
Upper Clark Fork River	A	2	1.2.2	Provide instream flow downstream of Georgetown Lake	25	MDNRC, MFWP, BLM, NRCS, USFS, USFWS		500	20	20	20	20	20
Upper Clark Fork River	A	1	**1.3.1**	**Supply cold water**	25	MFWP, USFWS, BLM, PCTC, USFS		500	20	20	20	20	20
Upper Clark Fork River	A	1	**2.1.1**	**Remove barriers on Warm Springs, Twin Lakes, and Flint Creeks**	5	USFS, MFWP		300	100	100	50	50	
Upper Clark Fork River	E	3	2.3.1	Enhance Silver Lake adfluvial stock	25	MFWP		250	10	10	10	10	10
Upper Clark Fork River	E	3	2.3.2	Enhance migratory populations for conservation	25	MFWP		250	10	10	10	10	10
Upper Clark Fork River	C, E	1	**3.1.1**	**Aggressively protect remaining native species complexes**	25	MFWP, USFWS, BLM, PCTC, USFS		*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Upper Clark Fork River	C, E	1	**3.1.2**	**Isolate Harvey Creek from nonnative fish**	1	MFWP, USFS		25	25				
Rock Creek	A	2	1.1.1	Upgrade or relocate problem roads	25	USFS, MDNRC, PCTC, BLM, Counties, MDOT, USDOT		500	20	20	20	20	20
Rock Creek	A	2	1.2.1	Reduce East Fork Reservoir operational impacts	25	MDNRC, MFWP, USFS		500	20	20	20	20	20
Rock Creek	A	2	1.2.2	Provide instream flow downstream of dams	25	MDNRC, MFWP, USFS		250	10	10	10	10	10
Rock Creek	A	1	**1.3.1**	**Supply cold water**	25	MDNRC, MFWP, USFS		250	10	10	10	10	10
Rock Creek	E	3	2.2.1	Enhance East Fork Reservoir adfluvial stock	25	MDNRC, MFWP, USFS	See 1.2.1						
Blackfoot River	A	1	**1.1.1**	**Prioritize Blackfoot River tributaries for restoration**	25	MFWP, USFWS, BLM, PCTC, USFS		*					
Blackfoot River	A	1	**1.1.2**	**Improve habitat through BMPs and conservation easements**	25	MFWP, USFWS, BLM, PCTC, USFS		500	20	20	20	20	20
Blackfoot River	A	1	**1.1.3**	**Address roads and mitigate associated sediment concerns**	25	MFWP, USFWS, BLM, PCTC, USFS		500	20	20	20	20	20
Blackfoot River	A	1	**1.1.4**	**Reduce road impacts in Cottonwood and Monture Creeks**	10	MFWP, USFWS, BLM, PCTC, USFS		300	30	30	30	30	30
Blackfoot River	A	1	**1.1.5**	**Assess roads in North Fork Blackfoot**	10	MFWP, USFWS, BLM, USFS		100	10	10	10	10	10

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Blackfoot River	A	1	**1.1.6**	**Mitigate residential development impacts on Monture Creek**	25	MFWP, USFWS, BLM, PCTC, USFS		250	10	10	10	10	10
Blackfoot River	A	2	1.2.1	Mitigate sediment sources basinwide	25	MFWP, USFWS, BLM, PCTC, USFS		500	20	20	20	20	20
Blackfoot River	A	3	1.2.2	Address recreational use impacts	25	MFWP, USFWS, BLM, PCTC, USFS		250	10	10	10	10	10
Blackfoot River	A	2	1.2.3	Improve instream flows	25	MDNRC, MFWP, USFS		250	10	10	10	10	10
Blackfoot River	A	2	1.2.4	Improve passage and entrainment issues	25	MDNRC, MFWP, USFS		250	10	10	10	10	10
Blackfoot River	A	3	1.2.5	Restore instream habitat	25	MDNRC, MFWP, USFS		250	10	10	10	10	10
Blackfoot River	A	3	1.2.6	Improve spawning and rearing habitat	25	MFWP, USFS		250	10	10	10	10	10
Blackfoot River	A	1	**1.3.1**	**Restore Gold Creek watershed**	20	MFWP, USFWS, BLM, PCTC, USFS		2,000	100	100	100	100	100
Blackfoot River	A	1	**1.3.2**	**Protect water quality by removing feedlots**	25	MDEQ, MFWP, USFWS, BLM, USFS		*					
Blackfoot River	A	1	**1.3.3**	**Improve water quality**	25	MDEQ, MFWP, USFWS, BLM, USFS		500	20	20	20	20	20
Blackfoot River	A	1	**1.3.4**	**Supply cold water**	25	MDNRC, MFWP, USFS, USFWS, MDEQ		250	10	10	10	10	10

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Blackfoot River	E	1	**2.3.1**	**Enhance migratory populations for conservation**	25	MFWP		250	10	10	10	10	10
Blackfoot River	E	1	**2.3.2**	**Incorporate survey data into Blackfoot River core area threats assessment**	25	MFWP, USFWS, BLM, PCTC, USFS		*					
Blackfoot River	C, E	1	**3.1.1**	**Suppress nonnative fish**	25	MFWP, USFWS, BLM, PCTC, USFS		500	20	20	20	20	20
Blackfoot River	C, E	1	**3.1.2**	**Aggressively protect remaining native species complexes**	25	MFWP, USFWS, BLM, PCTC, USFS		*					
Clearwater River & Lakes	A	1	**1.1.1**	**Decommission roads in East Fork Clearwater**	5	MFWP, USFWS, USFS		100	20	20	20	20	20
Clearwater River & Lakes	A	1	**1.1.2**	**Restore habitat in West Fork Clearwater**	3	MFWP, USFWS, USFS		100	30	40	30		
Clearwater River & Lakes	A	1	**1.1.3**	**Reduce road density in Placid Creek watershed**	10	MFWP, USFWS, USFS		500	50	50	50	50	50
Clearwater River & Lakes	A	1	**1.1.4**	**Improve habitat through BMPs and conservation easements**	25	MFWP, USFWS, USFS		1,250	50	50	50	50	50
Clearwater River & Lakes	A	1	**1.1.5**	**Acquire conservation easements**	10	MFWP, USFWS, USFS	See 1.1.4						
Clearwater River & Lakes	A	2	1.2.1	Enhance instream flow in West Fork Clearwater	25	MFWP, USFWS, BLM, USFS		500	20	20	20	20	20
Clearwater River & Lakes	A	1	1.3.2	Supply cold water	25	MFWP, USFS, USFWS, MDNRC, MDEQ		250	10	10	10	10	10

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000) Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Clearwater River & Lakes	A	3	2.1.1	Improve passage and entrainment issues in Morrell Creek	25	MFWP, USFWS, USFS		50	2	2	2	2	2
Clearwater River & Lakes	C, E	1	**3.1.1**	**Suppress northern pike in Clearwater Lake chain**	25	MFWP		250	10	10	10	10	10
Clearwater River & Lakes	C, E	1	**3.1.2**	**Suppress competing or predating nonnatives in lakes to conserve adfluvial bull trout**	25	MFWP, USFWS, USFS	See 3.1.1						
Clearwater River & Lakes	C, E	1	**3.1.3**	**Minimize brook trout populations in SR tributaries**	25	MFWP, USFWS, USFS		500	20	20	20	20	20
West Fork Bitterroot River	A	3	1.2.1	Reduce Painted Rocks Reservoir operational impacts	25	MDNR, MFWP, USFS		500	20	20	20	20	20
West Fork Bitterroot River	C, E	1	**3.1.1**	**Minimize nonnative fish impacts**	25	MFWP, USFS, USFWS		500	20	20	20	20	20
Bitterroot River	A	1	**1.1.1**	**Improve Lolo Creek riparian habitat**	10	USFS, MFWP		100	10	10	10	10	10
Bitterroot River	A	1	**1.2.1**	**Assess and decommission roads in Lolo Creek watershed**	10	USFS, MFWP		200	20	20	20	20	20
Bitterroot River	A	1	**1.2.2**	**Add LWD in Lolo Creek watershed**	10	USFS, MFWP		300	30	30	30	30	30
Bitterroot River	A	1	**1.2.3**	**Provide instream flow downstream of Painted Rocks**	25	MDNR, MFWP, USFS		1,250	50	50	50	50	50
Bitterroot River	A	1	**1.2.4**	**Provide instream flow in tributaries downstream of dams**	25	USFS, MFWP		1,250	50	50	50	50	50
Bitterroot River	A	1	**1.3.1**	**Restore shade to reduce water temperature in Nez Perce Fork**	25	USFS, MFWP		500	20	20	20	20	20

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Bitterroot River	A	1	**1.3.2**	**Supply cold water**	25	MFWP, USFS, USFWS, MDNRC, MDEQ		500	20	20	20	20	20
Bitterroot River	A	1	**2.1.1**	**Improve Howard Creek and other Lolo Creek passage**	20	USFS, MFWP		200	10	10	10	10	10
Bitterroot River	A	1	**2.1.2**	**Improve Warm Springs Creek passage**	2	USFS, MFWP		100	10	90			
Bitterroot River	A	1	**2.1.3**	**Improve Boulder Creek passage**	25	USFS, MFWP		375	15	15	15	15	15
Bitterroot River	A	1	**2.1.4**	**Improve West Fork Bitterroot passage**	25	USFS, MFWP		2,500	100	100	100	100	100
Bitterroot River	E	2	2.3.1	Conserve and enhance Bitterroot River migratory populations	25	MFWP, USFWS, BLM, PCTC, USFS		*					
Bitterroot River	A	1	**3.1.1**	**Minimize nonnative brook and brown trout in known SR refugia**	25	MFWP, USFS, USFWS		500	20	20	20	20	20
Bitterroot River	A	3	4.1.1	Conduct barrier assessment	5	MFWP, USFS		50	10	10	10	10	10
Middle Clark Fork River	A	1	**1.1.1**	**Improve Fish Creek riparian habitat**	10	USFS, MFWP		200	20	20	20	20	20
Middle Clark Fork River	A	1	**1.1.2**	**Improve road and timber BMPs in Fish Creek**	10	USFS, MFWP		200	20	20	20	20	20
Middle Clark Fork River	A	1	**1.1.3**	**Consolidate and minimize roads in South Fork Little Joe**	10	USFS		650	50	100	100	100	50
Middle Clark Fork River	A	2	**1.1.4**	**Consolidate and minimize roads in Ward Creek**	15	USFS		450	25	25	25	100	25
Middle Clark Fork River	A	2	**1.1.5**	**Consolidate and minimize roads in Twelvemile Creek**	20	USFS		200	10	10	10	10	10
Middle Clark Fork River	A	2	**1.1.6**	**Consolidate and minimize roads in Big Creek**	20	USFS		200	10	10	10	10	10

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Middle Clark Fork River	A	2	**1.1.7**	**Consolidate and minimize roads in Deer Creek**	20	USFS		200	10	10	10	10	10
Middle Clark Fork River	A	1	**1.1.8**	**Upgrade problem roads on Plum Creek Timber lands**	25	PCTC		250	10	10	10	10	10
Middle Clark Fork River	A	1	**1.2.1**	**Rehab Trout Creek mining claims**	10	USFS, MDEQ		250	25	25	25	25	25
Middle Clark Fork River	A	1	**1.2.2**	**Rehab Cedar Creek mining claims**	10	USFS, MDEQ		250	25	25	25	25	25
Middle Clark Fork River	A	1	**1.2.3**	**Increase LWD in Fish Creek and Trout Creek watersheds**	5	USFS, MFWP		250	50	50	50	50	50
Middle Clark Fork River	A	1	**1.2.4**	**Improve FMO habitat**	25	MFWP, USFWS, USFS, NWE		2,500	100	100	100	100	100
Middle Clark Fork River	A	1	**1.3.1**	**Continue stream temperature monitoring on Plum Creek Timber lands**	25	PCTC		25	1	1	1	1	1
Middle Clark Fork River	A	1	**1.3.2**	**Supply cold water**	25	MFWP, MDEQ, MDNRC, USFWS, USFS,		5,000	200	200	200	200	200
Middle Clark Fork River	A	2	2.1.1	Improve Albert Creek passage	20	USFS		400	20	20	20	20	20
Middle Clark Fork River	A	2	2.1.2	Improve Cedar Creek instream flow including mine site restoration	10	USFS, MDEQ		250	25	25	25	25	25
Middle Clark Fork River	A	2	2.3.1	Continue to emphasize systemwide connectivity	25	MFWP, USFWS, BLM, PCTC, USFS		*					
Middle Clark Fork River	C, E	1	**3.1.1**	**Reduce nonnative fish in Fish Creek**	10	USFS, MFWP		100	10	10	10	10	10
Estimated cost subtotal, Upper Clark Fork Geographic Region: $34,175,000 (over 25 years, minimum estimate)													

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000) Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Lower Clark Fork Geographic Region													
Lake Pend Oreille A	A	1	**1.1.1**	**Revegetate deficient riparian areas**	25	USFS, AVISTA, CSKT, FERC, MFWP, MDNRC, NRCS, USFWS, LCFWG, TU	See 1.1.2						
Lake Pend Oreille A	A	2	**1.1.2**	**Continue to Implement Appendix B of Avista Native Salmonid Restoration Plan CFSA to acquire and protect upland/riparian habitat**	25	AVISTA, MFWP, FERC, USFS, USFWS, LCWG		15,500	384	620	620	620	620
Lake Pend Oreille A	A	1	**1.1.3**	**Re-site utility corridor and access roads and revegetate riparian areas**	10	BPA, USFS, MFWP, MDNRC, PCTC, USFWS		1,000	100	100	100	100	100
Lake Pend Oreille A	A	1	**1.1.4**	**Re-site Cooper Gulch utility corridor and revegetate riparian area**	10	NWE, USFS, MFWP, MDNRC, USFWS		250	10	10	100	70	10
Lake Pend Oreille A	A	1	**1.1.5**	**Consolidate and minimize Crow Creek road network**	10	USFS, MFWP, MDNRC, USFWS		190	10	10	10	110	10
Lake Pend Oreille A	A	3	**1.1.6**	**Consolidate and minimize Dry Creek road network**	10	USFS, MFWP, MDNRC, USFWS		100	10	10	10	10	10
Lake Pend Oreille A	A	3	**1.1.7**	**Consolidate and minimize Clear Creek road network**	10	USFS, MFWP, MDNRC, USFWS		100	10	10	10	10	10

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Lake Pend Oreille A	A	1	**1.1.8**	**Consolidate and minimize Thompson River road network**	25	USFS, MFWP, MDNRC, PCTC, USFWS		5,000	200	200	200	200	200
Lake Pend Oreille A	A	1	**1.1.9**	**Consolidate and minimize Deerhorn Creek road network**	10	PCTC, USFS, MFWP, MDNRC, USFWS		200	20	20	20	20	20
Lake Pend Oreille A	A	1	**1.1.10**	**Consolidate and minimize West Fork Thompson River road network**	10	USFS, MFWP, MDNRC, PCTC, USFWS		750	100	300	50	25	25
Lake Pend Oreille A	A	1	**1.1.11**	**Consolidate and minimize Fishtrap Creek road network**	10	USFS, PCTC, MFWP, MDNRC, USFWS		750	100	300	50	25	25
Lake Pend Oreille A	A	1	**1.1.12**	**Consolidate and minimize Beatrice and Jungle Creek road network**	10	USFS, MFWP, MDNRC, PCTC, USFWS		250	10	100	70	10	10
Lake Pend Oreille A	A	1	**1.1.13**	**Consolidate and minimize Big Rock Creek road network**	10	USFS, MFWP, MDNRC, PCTC, USFWS		250	10	10	100	70	10
Lake Pend Oreille A	A	1	**1.1.14**	**Maximize implementing Plum Creek HCP in Thompson River watershed**	10	PCTC, USFWS, USFS		300	30	30	30	30	30
Lake Pend Oreille A	A	1	**1.1.15**	**Conduct riparian restoration on Plum Creek Timber lands on Mudd Creek**	25	PCTC		2,500	100	100	100	100	100
Lake Pend Oreille A	A	1	**1.1.16**	**Enhance Jocko River tributary habitat**	25	CSKT, ARCO		5,000	200	200	200	200	200
Lake Pend Oreille A	A	1	**1.1.17**	**Restore riparian and instream habitat in the mainstem Jocko River**	25	CSKT, ARCO		5,000	200	200	200	200	200

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Lake Pend Oreille A	A	1	**1.2.1**	**Improve instream habitat**	25	MFWP, CSKT, FERC, USFS, NRCS, USFWS, TU	See 1.1.2						
Lake Pend Oreille A	A	1	**1.2.2**	**Continue to implement Appendix B of Avista Native Salmonid Restoration Plan CFSA to improve and restore instream habitat**	25	MFWP, AVISTA, FERC, USFS, NRCS, USFWS, TU, LCFWG	See 1.1.2						
Lake Pend Oreille A	A	1	**1.2.3**	**Consolidate and minimize Thompson River road network**	25	USFS, MFWP, MDNRC, PCTC, USFWS	See 1.1.8						
Lake Pend Oreille A	A	1	**1.2.4**	**Protect and enhance Thompson River bull trout FMO corridor**	25	NWE, FERC, USFS, MFWP, NRCS, USFWS, TU	See 1.1.8 – 1.1.14						
Lake Pend Oreille A	A	1	**1.3.1**	**Implement Atlantic Richfield Corporation mitigation on Flathead Indian Reservation**	25	CSKT, ARCO	See 1.1.6 – 1.1.7						
Lake Pend Oreille A	A	1	**1.3.2**	**Reduce reservoir operational impacts**	25	AVISTA, CSKT, FERC, USFS, MFWP, NRCS, USFWS, TU	See 1.1.2						
Lake Pend Oreille A	A	1	**1.3.3**	**Reduce gas entrainment**	25	AVISTA, NWE, CSKT, FERC, USFS, MFWP, NRCS, USFWS, TU		20,000	800	800	800	800	800
Lake Pend Oreille A	A	1	**1.3.4**	**Restore instream LWD in Prospect Creek**	25	USFS, NWE, MFWP, MDNRC, USFWS		500	20	20	20	20	20

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Lake Pend Oreille A	A	1	**1.3.5**	**Continue stream temperature monitoring on Plum Creek Timber lands**	25	PCTC, MDNRC, USFS, MFWP		25	1	1	1	1	1
Lake Pend Oreille A	A	1	**1.3.6**	**Supply cold water**	25	MFWP, USFS, USFWS, MDNRC, MDEQ		500	20	20	20	20	20
Lake Pend Oreille A	A, D	1	**2.1.1.**	**Avista and partners will continue to collect adult bull trout below Cabinet Gorge Dam and transport them upstream to natal tributaries in Montana**	25	AVISTA, FERC, NWE, CSKT, IDFG, MFWP, USFWS		31,250	,250	1,250	1,250	1,250	1,250
Lake Pend Oreille A	A, D	1	**2.1.2**	**Avista and partners will improve upstream fish passage at Cabinet Gorge Dam**	25	AVISTA, FERC, MFWP, IDFG, USFWS		17,000	2,590	12,000	1,000	500	500
Lake Pend Oreille A	A, D	1	**2.1.3**	**Avista and partners will improve upstream fish passage at Noxon Rapids Dam**	25	Avista, FERC, MFWP, IDFG, USFWS		17,000	200	500	1,000	12,000	1,000
Lake Pend Oreille A	A, D	1	**2.1.4**	**Avista and partners will continue to transport and evaluate downstream transportation of juvenile bull trout.**	25	Avista, FERC, MFWP, IDFG, USFWS		10,000	400	400	400	400	400
Lake Pend Oreille A	A, D	1	**2.1.5**	**Avista and partners will evaluate performance of the Graves Creek permanent weir and investigate additional permanent trapping facilities.**	25	Avista, FERC, MFWP, IDFG, USFWS		10,000	400	400	400	400	400

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Lake Pend Oreille A	A, D	1	**2.1.6**	**Implement and monitor active fish screening and passage projects on the FAID canals**	25	CSKT		1,250	50	50	50	50	50
Lake Pend Oreille A	A	1	**2.1.7**	**Operate Thompson Falls Fishway to maximize upstream returns from Noxon Reservoir**	25	NWE, MFWP		1,250	50	50	50	50	50
Lake Pend Oreille A	A	1	**2.1.8**	**Oversee and fund Thompson Falls Fishway operations**	25	NWE	See 2.1.7						
Lake Pend Oreille A	A	1	**2.1.9**	**Develop and implement passage action at Thompson Falls Dam**	25	NWE	See 2.1.7						
Lake Pend Oreille A	A	1	**2.1.10**	**Develop revised fishway operations plan(s) as needed, at Thompson Falls Dam**	25	NWE	See 2.1.7						
Lake Pend Oreille A	A	1	**2.1.11**	**Seamless systemwide fish passage coordination in the lower Clark Fork River**	25	NWE, USFWS, MFWP	See 2.1.7						
Lake Pend Oreille A	A	1	**2.1.12**	**Upgrade problem roads on Plum Creek Timber lands**	10	PCTC		100	10	10	10	10	10
Lake Pend Oreille A	A, D	2	2.2.1	Continue to implement Appendices B and D of Avista CFSA	25	MFWP, AVISTA, FERC, USFS, USFWS		25,000	1,000	1,000	1,000	1,000	1,000
Lake Pend Oreille A	C, E	1	**3.1.1**	**Avista and partners will evaluate the East Fork Bull River nonnative fish suppression project and potential for similar projects**	25	MFWP, Avista, USFWS		200	40	40	40	40	40

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Lake Pend Oreille A	C, E	2	**3.1.2**	**Conduct Thompson Falls Reservoir assessment**	2	NWE, MFWP, USFWS		100	50	50			
Lake Pend Oreille A	A, D	3	4.1.1	Continue to implement research, monitoring, and evaluation tasks under Appendices B and C of the NSRP	25	AVISTA, FERC, CSKT, IDFG, MFWP, USFS, USFWS	See 1.1.2, 1.3.3, 2.1.1, 2.1.2, and 2.1.3						
Lake Pend Oreille A	A	3	4.1.3	Continue annual adaptive management funding and conduct upstream offsite mitigation	25	NWE	See 2.1.2, 2.1.3						
Lake Pend Oreille A	E	3	4.2.3	Continue bull trout abundance monitoring in Montana tributaries within Avista Project area	25	MFWP, Avista, CSKT, USFS, USFWS		250	10	10	10	10	10
Lake Pend Oreille A	E	3	4.2.5	Conduct bull trout and brown trout redd counts	25	MFWP, Avista, CSKT, USFS, USFWS	See 1.1.2						
Lake Pend Oreille A	A	3	4.2.7	Support scientific oversight by TAC	25	NWE, MFWP, CSKT, USFS, USFWS	See 1.1.2						
Lake Pend Oreille B	A	1	**1.1.1**	**Revegetate deficient riparian areas**	25	USFS, FERC, IDEQ, IDFG, IDL, ITD, NRCS, Avista, USFWS	See 1.1.2						
Lake Pend Oreille B	A	1	**1.1.2**	**Continue to implement Appendix A of Avista CFSA to acquire and protect upland and riparian habitat**	25	Avista, USFS, FERC, IDFG, USFWS		14,250	570	570	570	570	570
Lake Pend Oreille B	A	2	1.2.1	Continue to implement Appendix A of Avista CFSA to improve and restore instream habitat	25	Avista, USFS, FERC, IDEQ, IDFG, USFWS	See 1.1.2						

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Lake Pend Oreille B	A	2	4.1.1	Evaluate and prioritize persistency and resiliency of cold water patches	25	IDFG, USGS, USFWS		500	20	20	20	20	20
Lake Pend Oreille C	A	2	**1.1.1**	**Improve habitat through acquisitions and easements**	25	WDFW, KT, USFWS, USFS, POPUD, SCL, COE		5,000	200	200	200	200	200
Lake Pend Oreille C	A	2	**1.1.2**	**Improve habitat through restoration actions**	25	SCL, POPUD, WDFW, FS, USFWS, KT, and others		1,500	300	300	300	300	300
Lake Pend Oreille C	A	2	**1.2.1**	**Address mining impacts in Sullivan Creek**	10	WDFW, COE, USFWS,		1,000	100	100	100	100	100
Lake Pend Oreille C	A	2	**1.2.2**	**Improve instream conditions restoration actions including but not limited to channel improvement floodplain connectivity, and floodplain restoration**	25	SCL, POPUD, FS, WDFW, USFWS, KT, and others		1,500	300	300	300	300	300
Lake Pend Oreille C	A	2	**1.3.1**	**Manage water temperatures to support adfluvial migration**	25	POPUD, SCL, COE		2,500	100	100	100	100	100
Lake Pend Oreille C	A	2	**1.3.2**	**Reduce gas entrainment which causes supersaturation**	10	COE, POPUD, WDOE, USFWS	Design Only – construc-tion costs TBD	3,000	300	300	300	300	300
Lake Pend Oreille C	A	1	**2.1.1**	**Remove Mill Pond Dam**	3	POPUD, SCL, USFWS		300	100	100	100		
Lake Pend Oreille C	A	2	**2.1.2**	**Remove historic water diversions and log crib dams on LeClerc Creek**	3	USFS, USFWS, and others		300	100	100	100		

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Lake Pend Oreille C	A	1	**2.1.3**	**Improve passage and minimize entrainment at Albeni Falls and Box Canyon Dams**	5	COE, POPUD,	Design Only. Construct-ion Costs TBD	10,000	1,000	1,000	5,000	2,000	1,000
Lake Pend Oreille C	A	2	**2.1.4**	**Minimize entrainment at Boundary Dam**	20	SCL, USFWS	23M in 1st 18 years, construction late in future	2,500	500	500	500	500	500
Lake Pend Oreille C	A	2	**2.1.5**	**Improve passage and entrainment issues in tributary streams**	10	KT, USFWS, POPUD, WDFW	Design Only. Construct-ion Costs TBD	500	100	100	100	100	100
Lake Pend Oreille C	A	2	**2.1.6**	**Maintain and enhance connectivity of cold water patches**	25	WDFW, KT, USFWS, USFS, POPUD, SCL, COE		1,250	50	50	50	50	50
Lake Pend Oreille C	A, E	1	**2.3.1**	**Investigate re-introducing extirpated local populations**	5	USFWS, WDFW, KT, SCL,POPUD, USFS,		250	100	50	50	50	0
Lake Pend Oreille C	E	2	**2.3.2**	**Investigate the potential for an experimental population in Sullivan Lake and its tributaries**	15	USFWS and others		250	50	50	50	50	50
Lake Pend Oreille C	C, E	2	**3.1.1**	**Suppress nonnative predators and competitors in Lower Pend Oreille river**	25	KT, WDFW, USFWS		3,750	150	150	150	150	150
Lake Pend Oreille C	C, E	2	**3.1.2**	**Suppress competing and hybridizing nonnative brook trout in Lower Pend Oreille River**	25	WDFW, KT, POPUD, SCL, USFWS		3,750	150	150	150	150	150

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Lake Pend Oreille C	A, E	3	4.2.1	Complete Pend Oreille River bull trout reintroduction feasibility analysis	4	USFWS, SCL, POPUD, WDFW, KT, IDFG		150	50	50	50	0	
Lake Pend Oreille C	E	3	4.3.1	Develop Pend Oreille River native salmonid conservation plan	3	WDFW, USFWS, KT,		200	100	100	0		
Priest Lakes	A	1	**1.1.1**	**Improve tributary uplands and riparian**	25	IDL, USFS, IDEQ, ITD, NRCS, USFWS		2,500	100	100	100	100	100
Priest Lakes	A	2	1.2.1	Improve instream habitat	25	IDL, USFS, IDFG, KT, NRCS, USFWS		2,500	100	100	100	100	100
Priest Lakes	A	3	1.3.1	Focus water quality remediation efforts on TMDLs	10	EPA, IDEQ, WADOE, KT, USFS, USFWS		2,500	100	100	100	100	100
Priest Lakes	A	1	1.3.2	Supply cold water	25	IDFG, USFS, USFWS, IDEQ, IDL		500	20	20	20	20	20
Priest Lakes	A	2	2.1.1	Assess and eliminate culvert barriers	10	IDL, USFS, IDFG, KT, NRCS, USFWS		250	25	25	25	25	25
Priest Lakes	E	2	2.2.1	Aggressively protect Upper Priest Lake native species complex	25	IDFG, USFWS		*					
Priest Lakes	C, E	1	**3.1.1**	**Continue suppression of lake trout from Upper Priest Lake and prevent reinvasion**	10	IDFG, USFWS		1,000	100	100	100	100	100
Priest Lakes	C, E	1	**3.1.2**	**Suppress lake trout in Priest Lake**	25	IDFG, USFWS		25,000	1,000	1,000	1,000	1,000	1,000
Priest Lakes	C, E	1	**3.1.3**	**Suppress brook trout**	25	IDFG, USFWS		250	10	10	10	10	10
Estimated cost subtotal, Lower Clark Fork Geographic Region: $258,515,000 (over 25 years, minimum estimate)													

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Flathead Geographic Region													
Flathead Lake	A	2	1.1.1	Conserve existing habitat and support passive restoration	25	USFS, BPA, CSKT, USDOT, FBC, GNP, MDEQ, MDNRC, MDOT, MFWP, NRCS, USFWS		25,000	1,000	1,000	1,000	1,000	1,000
Flathead Lake	A	3	1.2.1	Improve productivity and stability by restoring habitat quality	25	USFS, BPA, CSKT, USDOT, FBC, GNP, MDEQ, MDNRC, MDOT, MFWP, NRCS, USFWS	See 1.1.1						
Flathead Lake	A	3	1.2.2	Follow VARQ flood control procedures at Hungry Horse	25	USBR, MFWP, BPA		*					
Flathead Lake	A	3	1.3.1	Limit spill at Hungry Horse to avoid exceeding Montana State TDG standards	25	USBR, MFWP, BPA		*					
Flathead Lake	A	1	1.3.2	Protect sources of cold water	25	MFWP, USFS, USFWS, MDNRC, MDEQ, BOR		250	10	10	10	10	10
Flathead Lake	B, D	1	**2.2.1**	**Continue protective angling regulations for Flathead Lake bull trout**	25	MFWP		*					
Flathead Lake	C, E	1	**2.2.2**	**Suppress nonnative fish through recreational angling**	25	CSKT, MFWP		500	20	20	20	20	20

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Flathead Lake	C, D	1	**2.2.3**	**Remove the lake trout slot limit on Flathead Lake**	1	CSKT, MFWP		0					
Flathead Lake		1	**2.2.4**	**Conduct educational outreach**	25	CSKT, MFWP, USFWS		250	10	10	10	10	10
Flathead Lake	C, E	1	**3.1.1**	**Revise and implement an updated Flathead Lake and River Co-Management Plan**	10	CSKT, MFWP		2,000	200	200	200	200	200
Flathead Lake	C, E	1	**3.1.2**	**Adopt a comprehensive strategy (EIS Alternative D) to suppress nonnative lake trout (age 8 and older) by 75%**	25	CSKT, MFWP		25,000	1,000	1,000	1,000	1,000	1,000
Flathead Lake	C, E	1	**3.1.3**	**Use multiple tools (*e.g.*, bounties, netting, commercial fishing) to suppress lake trout**	25	CSKT, MFWP	See 3.1.2						
Flathead Lake	C, E	1	**3.1.4**	**Consider commercial harvest of lake trout in State-managed waters**	25	CSKT, MFWP	See 3.1.2						
Flathead Lake	C, E	1	**3.1.5**	**Reduce and minimize northern pike in Flathead River**	25	CSKT, MFWP		625	25	25	25	25	25
Flathead Lake	E	3	4.2.1	Monitor bull trout abundance in Flathead Lake	25	CSKT, MFWP	See 3.1.1						
Flathead Lake	E	3	4.2.2	Monitor lake trout abundance in Flathead Lake	25	CSKT, MFWP	See 3.1.1						
Flathead Lake	E	3	4.2.3	Monitor abundance and trends of fish in the Flathead River and tributaries	25	CSKT, MFWP	See 3.1.1						
Flathead Lake	E	3	4.3.1	Evaluate and remediate declining bull trout redd counts in North Fork	25	CSKT, MFWP	See 3.1.1						

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Simple core areas in GNP (9)	A	3	2.1.1	Maintain natural barriers isolating GNP lakes	25	GNP, USGS, USFWS, MFWP		250	10	10	10	10	10
Simple core areas in GNP (9)	A	2	2.1.2	Construct and maintain artificial barriers downstream of some GNP lakes	25	GNP, USGS, USFWS, MFWP		2,500	100	100	100	100	100
Simple core areas in GNP (9)	C, E	1	**3.1.1**	**Minimize nonnative species transport through education and outreach**	25	GNP, USGS, USFWS, MFWP		*					
Simple core areas in GNP (9)	C, E	1	**3.1.2**	**Actively suppress existing population of lake trout in Quartz Lake system**	25	GNP, USGS, USFWS,		2,500	100	100	100	100	100
Simple core areas in GNP (9)	C, E	1	**3.1.3**	**Suppress nonnatives to restore remnant bull trout populations to sustainable levels**	25	GNP, USGS, USFWS,		5,000	200	200	200	200	200
Simple core areas in GNP (9)	C, E	1	**3.1.4**	**Continue ongoing AIS inspections of all watercraft entering GNP waters**	25	GNP		500	20	20	20	20	20
Simple core areas in Flathead basin (7)	A	1	**1.1.1**	**Conserve existing habitat and support passive restoration**	25	USFS, MDEQ, MDNRC, MFWP		750	30	30	30	30	30
Simple core areas in Flathead basin (7)	D	1	**2.2.1**	**Maintain angling regulations that minimize impacts on bull trout, maximizing harvest of nonnatives**	25	MFWP		*					
Simple core areas in Flathead basin (7)	C, E	1	**3.1.1**	**Consider installing barrier(s) to impede upstream spread of nonnative fish into Upper Whitefish, Frozen and Cyclone Lakes**	10	USFS, MDNRC, MFWP		50	5	5	5	5	5

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Simple core areas in Flathead basin (7)	C, E	1	**3.1.2**	**Suppress nonnatives to restore remnant bull trout populations in Upper Stillwater and Whitefish Lakes**	25	MFWP, MDNR, USFWS		5,000	200	200	200	200	200
Simple core areas in Flathead basin (7)	A	3	4.11	Monitor stream temperature	25	MDNR, MFWP		125	5	5	5	5	5
Simple core areas in Flathead basin (7)	E	3	4.21	Continue redd counts	25	MDNR, MFWP, USFS		500	20	20	20	20	20
Hungry Horse Reservoir	A	2	1.1.1	Conserve existing habitat and continue passive restoration	25	USFS, MFWP		*					
Hungry Horse Reservoir	A	2	1.2.1	Follow VARQ flood control procedures	25	USBOR, MFWP		*					
Hungry Horse Reservoir	C, E	2	4.3.1	Protect native species refugium	25	USFS, BPA, CSKT, FBC, GNP, MDNR, MFWP, USFWS		1,250	50	50	50	50	50
Swan, *Holland & Lindbergh* Lakes	C, E	1	**3.1.1**	**Develop and implement a Swan Lake management strategy**	5	MFWP, USFS, MDNR, USFWS		50	10	10	10	10	10
Swan, *Holland & Lindbergh* Lakes	C, E	1	**3.1.2**	**Suppress lake trout in Swan Lake**	25	MFWP, USFS, MDNR, TU, USFWS		2,500	100	100	100	100	100
Swan, *Holland & Lindbergh* Lakes	A	3	4.1.1	Monitor stream temperature	25	MDNR, USFS		50	2	2	2	2	2
Swan, *Holland & Lindbergh* Lakes	C, E	2	4.3.1	Manage brook trout populations in SR tributaries	25	USFS, MDNR, MFWP, USFWS		2,500	100	100	100	100	100

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000) Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Swan, *Holland & Lindbergh* Lakes	C, E	2	4.3.2	Evaluate lake trout suppression in Holland and Lindbergh	2	USFS, MFWP, USFWS		25	15	10			
Estimated cost subtotal, Flathead Geographic Region: $77,175,000 (over 25 years, minimum estimate)													
Kootenai Geographic Region													
Kootenai River	A	1	**1.1.1**	**Upgrade problem roads in Kootenai River Watershed**	25	USFS, IDEQ, IDFG, IDL, ITD, KTOI, MDNR, MDOT, MFWP, NRCS, PCTC, USFWS		2,500	100	100	100	100	100
Kootenai River	A	1	**1.1.2**	**Upgrade problem roads on Plum Creek Timber lands**	10	PCTC, USFS		1,000	100	100	100	100	100
Kootenai River	A	1	**1.1.3**	**Conduct riparian restoration on Plum Creek Timber lands**	25	PCTC, USFS		2,500	100	100	100	100	100
Kootenai River	A	1	**1.1.4**	**Rehab Libby Creek mining claims**	25	USFS, MDEQ		2,500	100	100	100	100	100
Kootenai River	A	1	**1.2.1**	**Restore stream channels in SR tributaries**	25	USFS, IDEQ, IDFG, IDL, ITD, KTOI, MDNR, MDOT, MFWP, NRCS, PCTC, USFWS		5,000	200	200	200	200	200

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Kootenai River	A	1	**1.2.2**	**Improve instream habitat in SR streams**	25	USFS, IDEQ, IDFG, IDL, ITD, KTOI, MDNR, MDOT, MFWP, NRCS, PCTC, USFWS	See 1.2.1						
Kootenai River	A	2	**1.2.3**	**Follow VARQ flood control procedures**	25	COE, BPA		*					
Kootenai River	A	3	1.3.1	Continue stream temperature monitoring on Plum Creek Timber lands	25	PCTC		125	5	5	5	5	5
Kootenai River	A	3	1.3.2	Reduce gas entrainment at Libby Dam	25	COE, BPA		*					
Kootenai River	A	1	1.3.3	Supply cold water	25	MFWP, IDFG,KTOI, USFS, USFWS, MDNRC, MDEQ, COE		500	20	20	20	20	20
Kootenai River	A	3	2.1.1	Improve Pipe Creek passage	5	USFS, MFWP		50	10	10	10	10	10
Kootenai River	C, E	1	**3.1.1**	**Remove established brook trout populations in SR tributaries**	25	MFWP, BPA, USFS, USFWS		2,500	100	100	100	100	100
Lake Koocanusa	A	2	1.2.1	Follow VARQ flood control procedures	25	COE, BPA		*					
Lake Koocanusa	A	2	2.1.1	Improve Grave Creek passage and minimize entrainment	10	USFS, MFWP, USFWS		500	50	50	50	50	50
Lake Koocanusa	C, D	2	3.1.1	Discourage unauthorized fish introductions	25	MFWP, USFWS, PCTC, USFS, B.C. Ministry		*					

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Lake Koocanusa	C, E	3	3.1.2	Minimize nonnative fish impacts	25	MFWP, USFWS, PCTC, USFS, B.C. Ministry		625	25	25	25	25	25
Lake Koocanusa	A	2	4.1.1	Monitor impacts of coal mining in British Columbia	25	MFWP, USFWS, US State Dept.		2,500	100	100	100	100	100
Lake Koocanusa	A	3	4.2.1	Examine loss of connectivity of bull trout at Libby Dam	25	BPA, COE, MFWP, USFWS		1,250	50	50	50	50	50
Bull Lake	A	2	**1.1.1**	**Conduct riparian restoration along Lake and Keeler creeks**	25	MFWP, USFWS, USFS, MDEQ		TBD					
Bull Lake	A	2	1.2.1	Improve instream habitat in Keeler Creek	25	MFWP, USFWS, USFS, MDEQ		TBD					
Bull Lake	C, E	2	**3.1.1**	**Evaluate suppression of existing population of nonnatives in Bull Lake**	25	MFWP, USFWS, USFS		TBD					
Estimated cost subtotal, Kootenai Geographic Region: $21,550,000 (over 25 years, minimum estimate)													

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Coeur d'Alene Geographic Region													
Coeur d'Alene Lake	A	2	1.1.1	Implement CERCLA activities in restoring upland and riparian	25	USFS, BLM, EPA, IDEQ, USFWS, CDA Tribe		125,000	5,000	5,000	5,000	5,000	5,000
Coeur d'Alene Lake	A	2	1.1.2	Improve Coeur d'Alene and St. Joe River habitat	25	USFS, BLM, EPA, IDEQ, USFWS, CDA Tribe	See 1.1.1						
Coeur d'Alene Lake	A	3	1.2.1	Enforce and evaluate existing mining regulations	25	USFS, BLM, EPA, IDEQ, USFWS, CDA Tribe		*					
Coeur d'Alene Lake	A	2	1.2.2	Implement CERCLA activities in restoring instream habitat	25	USFS, BLM, EPA, IDEQ, USFWS, CDA Tribe	See 1.1.1						
Coeur d'Alene Lake	A	1	**1.3.1**	**Identify sources of water temperature increases**	5	USFS, BLM, EPA, IDEQ, USFWS, CDA Tribe	See 1.1.1						
Coeur d'Alene Lake	A	1	**1.3.2**	**Identify and protect cold groundwater sources**	25	USFS, BLM, EPA, IDEQ, USFWS, CDA Tribe	See 1.1.1						
Coeur d'Alene Lake	A	1	**1.3.3**	**Implement CERCLA activities in remediating water quality**	25	USFS, BLM, EPA, IDEQ, USFWS, CDA Tribe	See 1.1.1						
Coeur d'Alene Lake	A	1	**1.3.4**	**Improve water quality in Coeur d'Alene tributaries**	25	USFS, BLM, EPA, IDEQ, USFWS, CDA Tribe	See 1.1.1						
Coeur d'Alene Lake	A	1	**1.3.5**	**Supply cold water**	25	IDFG, USFS, USFWS, IDL, IDEQ		500	20	20	20	20	20

Core Area	Threat Factor	Recovery Action Priority	Recovery Action Number	Recovery Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Coeur d'Alene Lake	A	1	**2.3.1**	**Incorporate survey data into Coeur d'Alene Lake core area threats assessment**	25	IDFG, USFS, USFWS, CDA Tribes		TBD					
Coeur d'Alene Lake	C, E	1	**3.1.1**	**Develop a nonnative suppression plan**	5	USFWS, IDFG, CDA Tribe	See 3.1.2						
Coeur d'Alene Lake	C, E	1	**3.1.2**	**Control nonnative fish in FMO habitat**	25	USFS, IDFG, USFWS, CDA Tribe		6,250	250	250	250	250	250
Coeur d'Alene Lake	A	2	4.1.3	Enhance supplies of cold water	25	USFS, BLM, EPA, IDEQ, USFWS, CDA Tribe		5,000	200	200	200	200	200
Coeur d'Alene Lake	A	3	4.2.4	Evaluate potential reintroduction	10	IDFG, USFWS, CDA Tribe		500	50	50	0	0	0
Estimated cost subtotal, Coeur d'Alene Geographic Region: $137,250,000 (over 25 years, minimum estimate)													
Time to Recovery (estimated time required to meet recovery criteria within this recovery unit – **25+ Years**													
Estimated total cost of recovery actions within this recovery unit **– 528.6 Million Dollars**													

Conservation Recommendations for the Columbia Headwaters Recovery Unit

Core Area	Threat Factor	Action Priority	Action Number	Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Upper Clark Fork Geographic Region													
Upper Clark Fork River	B, D	CR	2.2.1	Maintain angling closure for bull trout	25	MFWP							
Upper Clark Fork River	E	CR	2.2.2	Prioritize resident bull trout for conservation	25	MFWP, USFWS, BLM, PCTC, USFS							
Upper Clark Fork River	E	CR	2.3.3	Incorporate survey data into Upper Clark Fork River core area threats assessment	25	MFWP, USFWS, BLM, USFS, CSKT							
Upper Clark Fork River	E	CR	4.2.1	Improve knowledge of distribution	25	MFWP, USFWS, BLM, PCTC, USFS							
Rock Creek	A	CR	1.1.2	Prioritize Rock Creek and tributaries for restoration	25	MFWP, USFWS, BLM, PCTC, USFS							
Rock Creek	E	CR	2.3.1	Incorporate survey data into Rock Creek core area threats assessment	25	MFWP, USFWS, BLM, PCTC, USFS							
Blackfoot River	A	CR	4.1.1	Consider passage around natural barriers	5	MFWP, USFWS, USFS							
Clearwater River & Lakes	A	CR	1.3.1	Address recreation and residential impacts along Clearwater River and Morrell Creek	25	MFWP, USFS							
Clearwater River & Lakes	A	CR	2.1.2	Continue to emphasize systemwide connectivity	25	MFWP, USFWS, BLM, PCTC, USFS							
Clearwater River & Lakes	A	CR	2.1.3	Conserve and enhance migratory populations	25	MFWP, USFWS, BLM, PCTC, USFS							

Core Area	Threat Factor	Action Priority	Action Number	Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Clearwater River & Lakes	E	CR	2.3.1	Incorporate survey data into Clearwater River & Lakes core area threats assessment	25	MFWP, USFWS, BLM, USFS, CSKT							
West Fork Bitterroot River	E	CR	4.2.1	Improve knowledge of distribution	25	MFWP, USFWS, BLM, PCTC, USFS							
Bitterroot River	E	CR	2.3.2	Incorporate survey data into Bitterroot River core area threats assessment	25	MFWP, USFWS, BLM, PCTC, USFS							
Bitterroot River	A	CR	4.2.1	Quantify entrainment losses in diversions	25	MDNR, USFS, MFWP							
Bitterroot River	E	CR	4.2.2	Improve knowledge of distribution	25	MFWP, USFWS, BLM, PCTC, USFS							
Bitterroot River	A	CR	4.2.3	Consider passage around natural barriers	10	USFS, MFWP, USFWS							
Bitterroot River	C, E	CR	4.3.1	Establish distribution of nonnative trout	25	MFWP, USFS, USFWS							
Middle Clark Fork River	E	CR	2.3.2	Incorporate survey data into Middle Clark Fork River core area threats assessment	25	MFWP, USFWS, BLM, PCTC, USFS							
Middle Clark Fork River	A	CR	4.1.1	Conduct post-fire fish population monitoring in West Gold Creek	2	PCTC							
Middle Clark Fork River	A	CR	4.1.2	Evaluate grazing sites on Plum Creek Timber lands	5	PCTC							
Middle Clark Fork River	A	CR	4.1.3	Conduct 15-year review of Plum Creek HCP	2	PCTC							

Core Area	Threat Factor	Action Priority	Action Number	Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Lower Clark Fork Geographic Region													
Lake Pend Oreille A	E	CR	2.3.1	Incorporate survey data into Lake Pend Oreille core area threats assessment for LPO-A area	25	MFWP, CSKT, USFWS, USFS							
Lake Pend Oreille A	A	CR	4.1.2	Conduct limiting factors analysis	2	Avista, MFWP	See 2.1.3						
Lake Pend Oreille A	A	CR	4.1.4	Evaluate Big Rock Creek	5	NWE, USFS, MFWP	See also 1.1.5, 2.1.19 and 2.1.23						
Lake Pend Oreille A	A	CR	4.1.5	Evaluate grazing sites on Plum Creek Timber lands	5	PCTC							
Lake Pend Oreille A	A	CR	4.1.6	Conduct 15-year review of Plum Creek HCP	2	PCTC							
Lake Pend Oreille A	A	CR	4.2.1	Assess recruitment value of the lower Flathead River	10	CSKT							
Lake Pend Oreille A	A, E	CR	4.2.2	Consider reintroduction of bull trout where extirpated	25	CSKT							
Lake Pend Oreille A	A	CR	4.2.4	Continue reservoir monitoring	25	MFWP, Avista, CSKT, USFS, USFWS	See also 1.1.2 and 2.1.3						
Lake Pend Oreille A	A, D	CR	4.2.6	Conduct bull trout genetic testing and permanent tagging at Thompson Falls fishway	25	Avista, MFWP, CSKT, USFS, USFWS	See also 1.1.2 and 2.1.3						
Lake Pend Oreille A	A	CR	4.2.8	Assess potential for bull trout occupancy in Thompson River tributaries	25	Avista, MFWP, CSKT, USFS, USFWS	See also 1.1.2 and 2.1.3						
Lake Pend Oreille A	E	CR	4.2.10	Improve knowledge of distribution and life history forms	25	Avista, MFWP, CSKT, USFS, USFWS	See also 1.1.2 and 2.1.3						

Core Area	Threat Factor	Action Priority	Action Number	Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Lake Pend Oreille A	C, E	CR	4.3.1	Investigate further suppression of nonnatives	25	Avista, MFWP, CSKT, USFS, USFWS	See also 1.1.2 and 2.1.3						
Lake Pend Oreille B	A	CR	1.3.1	Reduce LPO operational impacts	25	COE, FERC, IDFG, USFWS							
Lake Pend Oreille B	A	CR	1.3.2	Reduce gas entrainment which causes supersaturation	25	Avista, COE, FERC, IDEQ, IDFG, USFWS	See also LPO-A 1.3.3						
Lake Pend Oreille B	A	CR	1.3.3	Maintain and supplement sources of cold water	25	Avista, USFS, FERC, IDEQ, IDFG, IDL, ITD, NRCS, USFWS							
Lake Pend Oreille B	A, D	CR	2.1.1	Implement Federal Power Act mitigation for Albeni Falls Dam	25	COE, BPA, IDFG, USFWS							
Lake Pend Oreille B	C, E	CR	2.2.1	Minimize bull trout bycatch mortality	25	Avista, BPA, IDFG, USFWS	See 3.1.1						
Lake Pend Oreille B	E	CR	2.2.2	Avista and partners will conduct education and outreach	25	IDFG, USFWS, Avista, TU	See 1.1.2						
Lake Pend Oreille B	B, D	CR	2.2.3	Restore bull trout angling opportunity in Lake Pend Oreille	10	IDFG, USFWS							
Lake Pend Oreille B	E	CR	2.3.1	Incorporate survey data into Lake Pend Oreille core area threats assessment for LPO-B area	25	IDFG USFWS, USFS, KTOI							
Lake Pend Oreille B	C, E	CR	3.1.1	Suppress lake trout in Lake Pend Oreille	25	IDFG, BPA, USFWS, Avista							
Lake Pend Oreille B	E	CR	4.2.1	IDFG and partners will conduct redd counts in LPO tributaries	25	IDFG, USFWS, Avista							
Lake Pend Oreille B	E	CR	4.2.2	Evaluate bull trout stock diversity	10	Avista, IDFG, USFWS							

Core Area	Threat Factor	Action Priority	Action Number	Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Lake Pend Oreille C	C, E	CR	2.2.1	Prevent illegal introductions	25	IDFG, KT, WDFW, USFWS							
Lake Pend Oreille C	C, E	CR	2.2.2	Suppress nonnatives through angling	25	WDFW, KT, USFWS							
Lake Pend Oreille C	C, D	CR	2.2.3	Eliminate creel limit on brook trout	2	WDFW, KT, USFWS							
Lake Pend Oreille C	E	CR	2.3.3	Incorporate survey data into Lake Pend Oreille core area threats assessment for LPO-C area	25	IDFG, WDFW, USFWS, USFS, KTOI							
Priest Lakes	E	CR	2.3.1	Incorporate survey data into Priest Lakes core area threats assessment	25	IDFG, USFWS, USFS							
Priest Lakes	E	CR	4.2.1	Improve knowledge of distribution	10	IDFG, USGS, USFWS							
Priest Lakes	E	CR	4.3.1	Evaluate extent of hybridization between bull trout and brook trout	5	IDFG, USFWS, KT							
Flathead Geographic Region													
Flathead Lake	E	CR	2.3.1	Incorporate survey data into Flathead Lake core area threats assessment	25	MFWP, USFWS, USFS, CSKT, NPS							
Flathead Lake	E	CR	4.1.1	Improve capability to predict fish community response to physical and biological changes	25	CSKT, MFWP	See 3.1.1						
Simple core areas in GNP (9)	B, D	CR	2.2.1	Maintain angling regulations that minimize impacts on bull trout	25	GNP, USGS, USFWS, MFWP							
Simple core areas in GNP (9)	E	CR	4.2.1	Conduct research to document baseline conditions of naturally functioning simple core areas	25	GNP, USGS, USFWS							

Core Area	Threat Factor	Action Priority	Action Number	Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000) Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Hungry Horse Reservoir	A, B	CR	2.2.1	Provide regulated fishery in Hungry Horse Reservoir	25	MFWP, USFWS							
Hungry Horse Reservoir	E	CR	2.3.1	Incorporate survey data into Hungry Horse Reservoir core area threats assessment	25	MFWP, USFWS, USFS							
Hungry Horse Reservoir	A, E	CR	4.2.1	Investigate opportunities for translocation	5	USFS, MFWP, USFWS							
Swan, *Holland & Lindbergh* Lakes	B, D	CR	2.2.1	Continue protective angling regulations	25	MFWP							
Swan, *Holland & Lindbergh* Lakes	E	CR	2.3.1	Enhance migratory populations	25	USFS, BPA, CSKT, FBC, GNP, MDNR, MFWP, USFWS							
Swan, *Holland & Lindbergh* Lakes	E	CR	2.3.2	Incorporate survey data into Swan Lake core area threats assessment	25	MFWP, USFWS, USFS							
Kootenai Geographic Region													
Kootenai River	E	CR	2.3.1	Incorporate survey data into Kootenai River core area threats assessment	25	MFWP, USFWS, USFS							
Kootenai River	A	CR	4.1.1	Monitor and evaluate Kootenai River nutrient enrichment	25	IDEQ, IDFG, KTOI, USFWS							
Kootenai River	A	CR	4.1.2	Conduct experimental nutrient injection	10	IDEQ, IDFG, KTOI, USFWS	See 4.1.1						
Kootenai River	A	CR	4.1.3	Evaluate grazing sites on Plum Creek Timber lands	25	PCTC							
Kootenai River	A	CR	4.1.4	Conduct 15-year review of Plum Creek HCP	2	PCTC							

Core Area	Threat Factor	Action Priority	Action Number	Action Description	Action Duration	Responsible Parties	Comment	Estimated Costs (x $1,000)					
								Total Cost	FY 16	FY 17	FY 18	FY 19	FY 20
Kootenai River	E	CR	4.2.1	Improve knowledge of migratory patterns and distribution	25	USFS, MFWP, USGS, USFWS							
Lake Koocanusa	B, D	CR	2.2.1	Provide regulated fishery in Lake Koocanusa	25	MFWP, USFWS							
Lake Koocanusa	B, D	CR	2.2.2	Continue cooperative transboundary angling regulation evaluations	25	MFWP, USFWS, B.C. Ministry							
Lake Koocanusa	E	CR	2.3.2	Incorporate survey data into Lake Koocanusa core area threats assessment	25	MFWP, USFWS, USFS, BCME							
Coeur d'Alene Geographic Region													
Coeur d'Alene Lake	A	CR	4.1.1	Evaluate current and legacy land and water management effects	25	USFS, BLM, EPA, IDEQ, USFWS, CDA Tribe	See 1.1.1						
Coeur d'Alene Lake	A	CR	4.1.2	Complete watershed assessment	10	USFS, BLM, EPA, IDEQ, USFWS, CDA Tribe	See 1.1.1						
Coeur d'Alene Lake	E	CR	4.2.1	Research bull trout life history	5	IDFG, USFWS, CDA Tribe							
Coeur d'Alene Lake	E	CR	4.2.2	Conduct genetic analysis	10	IDFG, USFWS, CDA Tribe							
Coeur d'Alene Lake	E	CR	4.2.3	Improve knowledge of distribution	10	IDFG, USFWS, CDA Tribe							

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APPENDICES

Appendix I. Core Areas and Local Populations within the Columbia Headwaters Recovery Unit

Comprehensive list of bull trout core areas and local populations in the Columbia Headwaters Recovery Unit. Core areas and local pops are arranged in hydrologic order from the headwaters downstream. Complex core areas (multiple local populations) are bolded. Local populations highlighted with an asterisk (*) are either wholly in Canada or are currently unoccupied potential local populations (PLP). As such, these are not, technically, counted as local populations under the Endangered Species Act listed entity or added into the total, though Canadian populations may contribute bull trout to the core area. All streams are in Montana unless otherwise indicated.

Core Area	**Major Geographic Region**	**Local population(s)** (Creeks unless otherwise described**)**
Upper Clark Fork River (Upstream of Blackfoot River) N = 3 local pops.	Clark Fork	Warm Springs Twin Lakes Boulder
Rock Creek N = 9 local pops.	Clark Fork	Middle Fork Rock E. Fork Rock W. Fork Rock Ross Fork Rock Stony Hogback Butte Cabin Welcome Ranch
Blackfoot River N = 6 local pops.	Clark Fork	Landers Fork No. Fork Blackfoot R. Monture Cottonwood Belmont Gold
Clearwater River and Lakes N = 4 local pops.	Clark Fork	E. Fork Clearwater R. W. Fork Clearwater R. Morrell Placid

Core Area	Major Geographic Region	Local population(s) (Creeks unless otherwise described)
West Fork Bitterroot River (Painted Rocks Reservoir) N = 6 local pops.	Clark Fork	Little Boulder Deer Hughes Overwhich Blue Joint Slate
Bitterroot River N = 14 local pops.	Clark Fork	E. Fork Bitterroot R. *(headwaters complex* - *Meadow Creek up)* Tolan Warm Springs West Fork Bitterroot River *(lower)* Nez Perce Fork Boulder Tin Cup Lost Horse Sleeping Child Skalkaho Blodgett Fred Burr Burnt Fork Lolo
Middle Clark Fork River (Flathead River to Blackfoot River) N = 10 local pops.	Clark Fork	Rattlesnake Grant Albert Petty Fish Trout Cedar North Fork Little Joe South Fork Little Joe Ward

Core Area	**Major Geographic Region**	**Local population(s)** (Creeks unless otherwise described**)**
Flathead Lake N = 17 local pops. & British Columbia	Flathead	No. Fork Flathead R. *(B.C.)* * Sage *(B.C.)* * Couldrey *(B.C.)* * Starvation *(B.C.)* * Howell *(B.C.)* * Kishinehn *(part in B.C.)* Trail Whale Red Meadow Coal Big Strawberry Bowl Clack Schafer Morrison Granite Long Bear Ole Park Nyack
Frozen Lake	Flathead	Frozen *(part in B.C.)*
Upper Kintla Lake	Flathead	Kintla
Akokala Lake	Flathead	Akokala
Bowman Lake	Flathead	Bowman
Cerulean/Quartz/Mid. Quartz Lake	Flathead	Quartz
Lower Quartz Lake	Flathead	Quartz
Cyclone Lake	Flathead	Cyclone
Logging Lake	Flathead	Logging
Trout and Arrow Lakes	Flathead	Camas
Isabel Lakes	Flathead	Park
Harrison Lake	Flathead	Harrison
Lincoln Lake	Flathead	Lincoln
Upper Stillwater Lake	Flathead	Stillwater R.
Upper Whitefish Lake	Flathead	E. Fork Swift
Whitefish Lake	Flathead	Swift

Core Area	**Major Geographic Region**	**Local population(s)** (Creeks unless otherwise described)
Hungry Horse Reservoir N = 10 local pops.	Flathead	Danaher Youngs Gordon White R. Little Salmon Bunker Spotted Bear R. Sullivan Wheeler Wounded Buck
Doctor Lake	Flathead	Doctor
Big Salmon Lake	Flathead	Big Salmon
Swan Lake N = 9 local pops.	Flathead	Elk Cold Jim Piper Lion Goat Woodward Soup Lost
Lindbergh Lake	Flathead	Swan R.
Holland Lake	Flathead	Holland

Core Area	Major Geographic Region	Local population(s) (Creeks unless otherwise described)
Lake Pend Oreille *(Montana and Idaho)* (including former lower Clark Fork River and lower Flathead River core areas) N = 35 local pops.	Clark Fork	Post Mission Dry So. Fork Jocko R. Middle Fork Jocko R. No. Fork Jocko R. Bull R. Fishtrap W. Fork Thompson R. *Thompson Falls Dam - MT* Prospect Graves Vermilion R. Swamp *Noxon Rapids Dam - MT* Rock Bull R. *Cabinet Gorge Dam - ID* Lightning Rattle Wellington Porcupine East Fork Lightning Char Savage Morris Johnson Gold North Gold Granite Sullivan Springs Strong Trestle Pack R. Grouse Caribou Middle Fork East R. Uleda *Albeni Falls Dam - ID* Indian *(PLP) * (WA)* Calispell *(PLP) * (WA)* Tacoma *(PLP) * (WA)* Mill *(PLP) * (WA)* LeClerc (historic) *(WA)* Ruby *(PLP) * (WA)* Cedar *(PLP) * (WA)* *Box Canyon Dam - WA* Sullivan *(PLP) *(WA)*

Core Area	**Major Geographic Region**	**Local population(s)** (Creeks unless otherwise described)
Priest Lakes *(Idaho)* N = 5 local pops.	Clark Fork	Upper Priest River *(ID)* Hughes Fork *(ID)* Gold *(ID)* North Fork Granite *(ID)* North Fork Indian *(ID)*
Lake Koocanusa N = 2 local pops. & British Columbia	Kootenai	White R. *(B.C.)* * Skookumchuck Cr. *(B.C.)* * Wigwam R. *(part in B.C.)* Grave
Kootenai River N = 8 local pops.	Kootenai	West Fisher Libby Pipe Quartz O'Brien Callahan Boulder *(ID)* Long Canyon *(ID)*
Bull Lake	Kootenai	Keeler
Coeur d'Alene Lake N = 5 local pops.	Coeur d'Alene	St. Joe R. Wisdom Medicine Heller Bean *(headwaters complex: NF Bean, Tinear, and Mill)*

Appendix II. Completed Recovery Tasks from 2002 Draft Recovery Plan

Partial list of recovery tasks, per the 2002 Draft Recovery Plan, determined to be fully accomplished in the 15 complex core areas by the end of 2014. Additional tasks specific to 20 simple core areas were also accomplished, but are not displayed here.

1.1.5 - Upper Clark Fork River - Monitor McDonald Gold Mine. Monitor the application status of the former McDonald Gold Mine near Lincoln and, if mine operations move forward, implement mitigation actions to reduce the potential negative effects on water quality and quantity.

1.1.5 - Flathead Lake - Monitor existing and future coal mine development in British Columbia. Monitor sediment and potential acid mining runoff related to existing and proposed coal mining activities in the British Columbia portion of the North Fork Flathead River.

1.1.6 - Upper Clark Fork River - Restore fish passage at Milltown Dam. Monitor and participate (representing bull trout concerns) in Superfund processes designed to decide the fate of Milltown Dam and the heavy metal deposits stored behind it. Fully restoring fish passage and eliminating the threat of toxic sediment discharge during runoff events are important elements for reducing fragmentation and supporting bull trout recovery.

1.1.7 - Lake Pend Oreille - Reduce nutrient input. Assess and, if needed, address effects of nutrient enrichment from Missoula Municipal Sewage Plant, Stone Container Mill, and shoreline development at Lake Pend Oreille.

1.2.1 - Coeur d'Alene Lake -Identify barriers to fish passage. Identify complete or seasonal barriers at stream crossings that inhibit or prevent bull trout from using habitat upstream, for example, at culverts.

1.2.1 - Northeast Washington (LPO-C) - Provide fish passage at Cedar Creek Dam. Investigate options and design fish passage through the municipal dam (for the town of Ione) on Cedar Creek (Pend Oreille County).

1.2.2 - Kootenai River - Provide fish passage around diversions. Install appropriate fish passage structures around diversions on bull trout streams and/or remove related migration barriers in Montana: Grave Creek, O'Brien Creek (Troy WS Diversion).

1.2.4 - Kootenai River - Improve instream flows. Restore connectivity and opportunities for migration by securing or improving instream flows and acquiring water rights from willing sellers; priority streams identified to date in Montana: Callahan Creek, Keeler Creek (upper), Libby Creek, and O'Brien Creek; Idaho: Boundary Creek.

1.3.7 - Lake Pend Oreille - Develop habitat restoration/protection guidelines. Develop and implement guidelines for bull trout that restore or maintain habitat elements (*e.g.*, sediment delivery, water temperature, normative hydrologic function) to provide for recovery.

1.5.4 - Coeur d'Alene Lake - Determine changes to the hydrograph. Assess current and historic effects of upland management on changes to the hydrograph, for example, timing and magnitude of peak flows.

2.1.1 - Lake Pend Oreille - Review fish stocking programs. Review annual fish stocking programs to minimize potential conflict with this bull trout recovery plan.

2.1.1 - Kootenai River - Upgrade fish hatchery practices. Evaluate all fish stocking programs and private and public hatchery practices to minimize the risk of further inadvertent introduction of nonnative species to the Kootenai River drainage.

2.3.1 - Lake Pend Oreille - Discourage unauthorized fish introductions. Implement educational efforts about the problems and consequences of unauthorized fish introductions.

2.5.2 - Priest Lakes - Evaluate the potential for a barrier in the Thorofare to control the migration of nonnative fish. Investigations in Upper Priest Lake have indicated that aggressive netting could effectively control lake trout, but that rapid reinvasion by lake trout occurs from downstream Priest Lake.

2.5.2 - Flathead Lake -Suppress brown trout in Mill Creek. Remove newly established reproducing brown trout population from Mill Creek in the Flathead River drainage.

2.6.1 - Northeast Washington (LPO-C) - Liberalize harvest regulations to reduce nonnatives where bull trout will benefit.

3.2.1 - Lake Pend Oreille - Minimize unintentional mortality of bull trout. Continue to develop and implement sport angling regulations and fisheries management plans, guidelines, and policies that minimize unintentional mortality of bull trout in Lake Pend Oreille, the Clark Fork River, and the mainstem reservoirs.

3.2.2 - Lake Pend Oreille - Evaluate enforcement of angling regulations and oversee scientific research. Ensure compliance with angling regulations and scientific collection policies and target bull trout spawning and staging areas for enforcement.

3.2.3 - Lake Pend Oreille - Implement angler education efforts. Inform anglers about special regulations and about how to identify bull trout and reduce hooking mortality of bull trout caught incidentally in Lake Pend Oreille, the Clark Fork River, and the mainstem reservoirs.

3.3.1 - Priest Lakes - Discourage illegally introduced sport fish populations. Adopt an aggressive approach to angling regulations and fisheries management that actively avoids legitimizing fisheries for illegally established populations of nonnative fish in the future and that supports minimizing the presence of and/or removing illegally introduced fish.

5.5.2 - Flathead Lake - Evaluate bull trout population and habitat in Tally Lake watershed to determine potential core area status. Bull trout have been historically documented in low numbers in this lake, but there is a natural barrier on the lower reaches of the inlet stream (Logan Creek) and whether the accessible portion of Logan Creek ever provided suitable spawning and rearing habitat is uncertain.

4.1.1 - Kootenai River -Continue coordinated genetic inventory throughout recovery unit, emphasizing origin of bull trout captured from the mainstem Kootenai River between Libby Dam and Kootenay Lake.

Appendix III. Summary of the Comments on the Draft Recovery Unit Implementation Plan for the Columbia Headwaters Recovery Unit

Background

On June 4, 2015, we released draft recovery unit implementation plans (RUIPs) for the six recovery units that comprise the coterminous United States Population of bull trout for a 45-day comment period for Federal agencies, Native American Tribes, State and local governments, and members of the public. The public comment period ended on July 20, 2015.

This section provides a summary of general information about the comments received specific to the Columbia Headwaters RUIP (USFWS 2015b), including the numbers and breakdown of comments (letters) from various sources.

We received 18 comment letters for the Columbia Headwaters RUIP. Comment letters were received from the following sources:

Federal Agencies (1)

State Agencies (4)

Native American Tribes (2)

Utilities/Commissions/Counties (3)

Environmental/Conservation Organizations (7)

Individuals (1)

Public comments ranged from editorial suggestions to providing new information. As appropriate, we have incorporated all applicable edits and suggestions into the text of the final Columbia Headwaters RUIP. The following is a summary of substantive comments, and our responses to those comments and suggestions, that were either not incorporated into the Columbia Headwaters RUIP or that were incorporated partially or fully but need additional explanation or justification. General or global comments pertaining to rangewide recovery issues for bull trout are addressed in Appendix D of the final recovery plan (USFWS 2015a).

1. *Comment:* Numerous commenters suggested revisions or changes in the list of threats, ongoing conservation actions, or proposed recovery measures for the Columbia Headwaters RUIP.

Response: New information and suggested revisions or changes have been incorporated and updated in the final Columbia Headwaters RUIP. The List of Primary Threats presented in the RUIP was developed by starting with the threat list identified from the 2002 Draft Recovery Plan and then gathering input through a series of interagency workshops. While not a consensus process, it incorporated broad input and represents the judgment of the Service based on best available science. In most cases, where commenters felt threats were omitted, it reflects impacts to one or a few local populations that were not, in our judgment, broadly distributed enough throughout the core area to rise to the level of being considered a primary threat.

2. *Comment:* A commenter believed the Salmo River Core Area should be included in the Columbia Headwaters Recovery Unit.

Response: The Salmo Core Area remains in the Mid-Columbia Recovery Unit. Bull trout core areas included in the Columbia Headwaters Recovery Unit do not now, nor did they historically, overlap with anadromous salmon. Salmo River bull trout historically coexisted with anadromous steelhead and potentially chinook. Dunham *et al.* (2014) concluded that upstream gene flow of Salmo River populations with those in the Lake Pend Oreille likely did not occur due to historical natural barriers that limited upstream migration of bull trout.

3. *Comment:* Several commenters expressed concern there is no evidence of systematic data gathering and analysis to support Service evaluation of status and recovery within Recovery Units or across the range of the species.

Response: This comment is addressed in Appendix B of the recovery plan. We also note that the threat-based approach is by its very nature somewhat subjective and does not lend itself well to a systematic, structured, and highly analytical approach.

4. *Comment:* Commenters stated that the RUIP contains an extensive list of threats and related management tasks that are not universally necessary to address to assure bull trout persistence at the core area and ultimately the recovery unit level.

Response: We concluded, based in part on the range of opinions expressed by experts participating in our structured workshops, that this comment reflects a matter of opinion and other experts often disagreed. Our determinations, to the extent possible, have been based on best available science and, where necessary, err on the side of conserving bull trout.

5. *Comment:* Several commenters indicated that the Columbia Headwaters RUIP simply lists a broad array of recovery actions that agencies and private entities are already undertaking (and some that have already been completed)....including many that are mandated by FERC licenses or other agreements. Concern was expressed that presenting these "as if those measures are not already managing the threats they were specifically designed to address" is not accurate. Further, some of these commenters viewed it as inappropriate to include these tasks.

Response: To clarify, the introductory paragraphs to the Recovery Measures Narrative indicate that this RUIP highlights a compendium of previously devised bull trout recovery tasks taken from a multitude of existing plans, largely as a way of acknowledging and supporting ongoing recovery actions. These actions are included in the recovery plan because their successful implementation is an important element of the recovery strategy and will continue to contribute to meeting recovery criteria, and ultimately to delisting the species. Thus, their inclusion in the RUIP should in no way be construed as an indication that these tasks are considered inadequate or failing to accomplish their goals. However, where implementation of the identified tasks currently being accomplished may be either inadequate, incomplete, or have not yet produced the desired outcomes, their contribution to achieving bull trout recovery may be uncertain and subject to challenge, or additional or stronger actions may be warranted.

6. *Comment:* Many of the same commenters, as in #4 above, indicated that "effectively managed threats" should not be identified in the Threats Table. They argue that continuing to identify threats that are being handled as if they were unmanaged is misleading and pessimistic.

Response: The Table of Primary Threats does not discriminate between those which are "effectively managed" and those which are "unmanaged". That determination will be made at a future time when bull trout listing and recovery status are again under review. This RUIP is intended to guide recovery for the next 25 years and threats that were significant in the recent past could easily become significant again in the near future, if circumstances change. So, we believe that it remains appropriate to continue highlighting all significant threats, even those that currently are being actively managed.

7. *Comment:* Similar comments opine that: "The plan repeatedly downplays the progress made to improve conditions for bull trout over the past decade. ….discounts tens of millions of dollars committed and changes in management practices that have been implemented over the past 15 years. Moreover, it suggests that bull trout populations have not improved and threats haven't been effectively ameliorated in the past 10 years, which is not accurate."

Response: We agree that our partners have been responsible for a myriad of positive accomplishments in protecting and enhancing bull trout habitat, and we have summarized and acknowledged many of these ongoing actions in this RUIP in the section "Ongoing Columbia Headwaters Recovery Unit Conservation Measures". The primary focus of the RUIP is on identification of threats and integrating implementation strategies to alleviate those threats going forward. Overall, our most recent 5-year review (2008) did not indicate substantive improvement in the overall status and trend for bull trout in the Columbia Headwaters RU, though certainly progress has been made in some core areas or local populations.

8. *Comment:* A commenter noted that the Service should consider managing expectations and uncertainty and sharpening focus for identified primary threats with feasibility narratives, indicating how feasible certain recovery actions might be to accomplish and/or occur.

Response: The Service standard for managing threats is "best available science." The "feasibility" of implementation is no doubt greater for some recovery actions than for others, based in part on cost, available technology, or other factors. However, feasibility is also scaled by circumstances in individual core areas and cannot be easily captured in a narrative without weighing the potential costs and benefits on a case-by-case basis. We will continue to evaluate relative feasibility and cost-effectiveness of actions as we proceed with recovery implementation.

9. *Comment:* Of particular interest to multiple commenters were the recommendations to "establish demographic targets" and recommendations of specific targets in only some core areas. As one commenter stated: "These are, in fact, the "objective, measurable criteria" that recovery plans must have, (and that this one says it will not have) and that are necessary to meet recovery plan goals. The FWS must accept its responsibility to actually establish these demographic targets in this recovery plan (even when they have not yet been proposed by others)."

Response: This is a universal issue, which is addressed in Appendix B of the recovery plan. We note, however, that the uneven way that this issue was treated amongst complex core areas in the Columbia Headwaters Recovery Unit (largely an artifact of citing existing planning documents) was edited to provide a conservation recommendation of incorporating survey data as appropriate into the threats assessment process in all complex core areas.

10. *Comment:* Several commenters questioned the appropriateness of conservation recommendations to "….restore BLT angling opportunity". They suggested that the "idea that it is necessary to kill bull trout to save them is one that does not seem appropriate in a recovery plan, and raises questions of whether there is any scientific support for this approach."

Response: The most often cited primary threat in the Columbia Headwaters RU is species interaction with other nonnative "sport fish" species. Historically, the introduction and spread of nonnative species has been documented to have resulted, in large measure, from illegal introduction. The three core areas cited for additional angling opportunity (LPO, Hungry Horse Reservoir, and Lake Koocanusa) are extremely important to bull trout recovery and at high risk for future illegal introductions could be devastating. While individual bull trout may perish in a regulated sport fishery, fishery science supports the construct that it is possible to strengthen the demographic status of fish populations, even though selective removal of individuals occurs.

11. *Comment:* One commenter suggested that when referring to forest practices, logging, and sediment from roads we should preface those concerns by inserting the word "Legacy" throughout. A similar comment referred to only “improper” livestock grazing, not all livestock grazing, as a threat.

Response: Although the RUIP does characterize the legacy impacts of timber management as a threat, there are also often measurable ongoing impacts from both existing and planned future forestry and grazing activities, regardless of how well they are managed. In bull trout watersheds, such impacts from new activities where a Federal nexus occurs can typically be partially mitigated or minimized though Section 7 consultation (Federal lands). Elsewhere, where section 7 may not apply, impacts can be reduced by following State or Tribal BMPs or laws. Thus, while we agree past practices often had greater impacts than current ones, and that legacy effects sometimes continue to dominate, it is not accurate to say that all watershed effects are due only to legacy effects or only “improper” livestock grazing application.

12. *Comment:* One commenter alleges that the Service is: “….attempting to re-write history as it ignores baseline and status information that has been collected by your own agency and land management agencies on BLT over the last 20+ years. We are lead (sic) to believe that in many places where habitat is functioning at unacceptable risk and at risk that this does not constitute a "primary" threat to bull trout. This is an egregious oversight.”

Response: We disagree with the assertion that baseline and status information is being ignored. In this threat-based approach to recovery, in some core areas threats from nonnative fish or other factors are paramount and may take precedence over emphasizing restoration of habitat, which may be only slightly or moderately impaired.

13. *Comment:* A commenter indicated: "Above all, we are concerned with the identification of non-native fish species as a primary threat in 25 of the 35 Columbia Headwaters Recovery Unit core areas. We do not believe it is reasonable or necessary to suggest that bull trout conservation

in most of these 25 core areas will require perpetual, prohibitively costly, potentially ineffective, and likely controversial efforts to suppress nonnative fish."

Response: The determination that nonnative fish represent a primary threat in the majority of core areas in the Columbia Headwaters Recovery Unit is supported by the science and with the concurrence of many scientists who participated in the scoping workshops. The relative importance of this issue is elevated in the Columbia Headwaters RU due to the large number of adfluvial populations and the relative ease with which nonnative species seem to be established in lacustrine FMO habitat. While some suppression efforts may become necessary, not all such efforts are as characterized in the comment, and we have stressed the importance of developing innovative methods and new technology as well as collaboration and public support in order to overcome these obstacles (real or perceived) on a case-by-case basis.

14. *Comment:* A commenter questioned why lake trout suppression is a Priority 1 Recovery Action for Priest Lake – contending that is based on a (false) conclusion that Upper Priest is not secure despite five local populations and increasing trends in abundance.

Response: We maintain that as long as lake trout remain relatively unchecked in Priest Lake, they represent a significant (primary) threat to the bull trout core area population. Annual funding for lake trout suppression efforts in Upper Priest Lake is by no means guaranteed over the long-term and has been viewed as a temporary solution. It is our conclusion that management of Upper Priest Lake in isolation is insufficient to secure bull trout within the Priest Lakes core area.

15. *Comment:* Several comments asked why brown trout were not identified as a primary non-native threat to bull trout.

Response: We note that brown trout are considered a nonnative threat at some level, based in part on predation and competition effects. However, brown trout were not identified as a primary threat because the science has not yet led to definitive conclusions regarding whether they are actively displacing bull trout or merely replacing them at sites where the habitat quality for bull trout has declined. Additional research is needed in that regard.

16. *Comment:* A similar comment challenged the Service's premise that situationally warmwater and coolwater species (i.e., northern pike, smallmouth bass, walleye, etc.) may prey on bull trout to varying degrees and that while specificity and scientific certainty was lacking the weight of scientific evidence was compelling.

Response: We acknowledge that direct evidence of predation on sparsely populated bull trout is difficult to obtain and sometimes lacking. However, the circumstantial evidence for impacts of these nonnative predators is often strong and corroborated by other facts. As such, we believe nonnative warmwater and cool water predators may reflect an active threat in some bull trout core areas and we exercise best professional judgment in order to identify the nature and magnitude of that threat. Our use of the best science available was also informed by the input of professional biologists during the December 2014 workshops.

17. *Comment:* A commenter noted that while the RUIP states: "The 110 cold water patches that are projected to be persistent in the 2080 model scenario should be individually evaluated…." the Service subsequently failed to do so. In their words: “THIS is recovery planning and the DRAFT Recovery Plan does not do this, nor does it clearly make this a management action.”

Response: We note that the RUIP is an integrated element of the recovery plan, so inclusion in the RUIP constitutes inclusion in recovery planning. As we point out in the analysis, significantly more follow-up effort based on the best available science is needed, but was not available in the timeframe for this plan.

18. *Comment:* A similar comment indicated that: "The relationship among core areas and the relative rate of shrinkage of available SR habitat within individual core areas is important. We would like a better explanation of how this translates into recovery objectives and actions for specific areas.”

Response: Since the Climate Shield model was developed very recently and its use in mapping cold water SR patches is brand new, this is very much a work in progress. In addition, coupling this modeling with the emergence of refined e-DNA mapping capability will further allow us to describe and identify important habitats. We anticipate that the RUIP process will also be ongoing and subject to multiple revisions as the state of the science improves. For those reasons, the specific and detailed actions and objectives that are still emerging are better left to future planning efforts. We have, however, highlighted their importance in this RUIP.

19. *Comment:* A commenter notes that the RUIP states that as long as SR habitat is available, complex core areas with lakes and reservoirs offer resiliency against climate change. The commenter indicates that: “This indicates a need for complete review of reservoir operations, as well as scrutiny of habitat management around lakes and reservoirs.”

Response: We agree that review and potential modification of some reservoir operations within the constraints of existing commitments and uses, especially in smaller and shallower impoundments with minimal thermal refugia, will be important for future protection and recovery of bull trout. Similar actions have already occurred in large Federally-managed reservoirs such as Koocanusa and Hungry Horse. The impact of habitat management surrounding lakeshore FMO on bull trout recovery is less well known, but also deserving of further examination.

20. *Comment:* A commenter indicated that the final bull trout recovery plan should include a management action for the U.S. Forest Service (USFS) to formally incorporate the Bull Trout Conservation Strategy (BTCS) as agency policy by amending its forest plans.

Response: Though the BTCS was released and directed by the Regional Forester, it is not enforceable direction (as a formally promulgated rule would be). However, current USFS direction is requiring that the BTCS be used to inform individual Forest Plan revisions in places where the BTCS intersects with national forest boundaries. Once those Forest Plans have been consulted on by the Service and the final decisions have been issued, then they do become binding USFS policy.

21. *Comment:* In the Coeur d'Alene Lake core area a commenter indicated that despite recent research showing high predation rates by northern pike on westslope cutthroat trout in Coeur d'Alene Lake and potential impacts on migratory bull trout, no actions have implemented since the 2002 Draft Plan and none are proposed in this plan.

Response: We agree that there needs to be a more comprehensive plan to address nonnative predators in the Coeur d'Alene Lake core area. The Service is committed to establishing an interagency team to further assess the threat to bull trout from nonnative predators and development of a plan to control predators where they are impacting bull trout survival, and we have indicated that in a revised recovery action.

22. *Comment:* Another Coeur d'Alene Lake core area comment considered that the evaluation of potential reintroduction of bull trout in the Coeur d'Alene River was an inadequate response by the Service, and further indicated that such action needs to be linked to nonnative suppression effort.

Response: We agree that developing a reintroduction strategy for bull trout in this core area is important. However, we do not believe that this implementation plan is the appropriate forum for developing a comprehensive reintroduction strategy. Instead, once the recovery plan is finalized we are committed to assembling an interagency team to conduct a biological feasibility assessment as an important first step. Any next steps towards reintroduction would be decided by the outcome of the biological feasibility assessment.

23. *Comment:* A commenter noted that: "Both migratory and resident forms of bull trout should be of equal importance."

Response: We maintain that an emphasis on conservation of the migratory life history form is still the strategy most likely to conserve bull trout across the CHRU landscape. Most resident populations of bull trout in the CHRU are residual artifacts of previous migratory connectivity. This should not be interpreted as an indication that there might not be important or unique genetic or adaptive characteristics in resident populations worth conserving, but rather that the emphasis for recovery of bull trout in the CHRU should continue to be on the migratory life history.

24. *Comment:* Several comments indicated that Priority 3 recovery actions and conservation recommendations are typically not associated with a primary threat. An example is monitoring. Though monitoring is important, this commenter does not believe a lack of monitoring constitutes a primary threat. Therefore, it is the commenter's opinion that these Priority 3 recovery actions and conservation recommendations should be removed from the RUIPs.

Response: We note that, while Priority 3 recovery actions and conservation recommendations that are not specifically associated with primary threats are not required to meet recovery criteria, they remain an important element of the overall recovery strategy for purposes such as assessing progress toward meeting recovery criteria, providing research data to inform effective application of recovery actions, and forestalling the exacerbation of minor threats. Moreover, many of these actions are significant to our conservation partners. Thus, we have retained these actions in the RUIP as important supporting elements of the overall recovery plan.

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